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Bradley et al.

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(45) **Date of Patent: Sep. 20, 2016**

(54) **METHOD OF DETERMINING A MEDIA CLASS IN AN IMAGING DEVICE USING AN OPTICAL TRANSLUCENCE SENSOR**

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(22) Filed: **Aug. 24, 2015**

(51) **Int. Cl.**
H04N 1/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H04N 1/00724*** (2013.01); ***H04N 1/00058*** (2013.01); ***H04N 1/0075*** (2013.01); ***H04N 1/00734*** (2013.01); *H04N 2201/0094* (2013.01)

(58) **Field of Classification Search**
CPC H04N 1/00724; H04N 1/00726; H04N 1/0075
USPC 358/1.15
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2016/0004193 A1* 1/2016 Murrell G03G 15/50 399/67
2016/0044195 A1* 2/2016 Murrell H04N 1/00724 358/1.1

* cited by examiner

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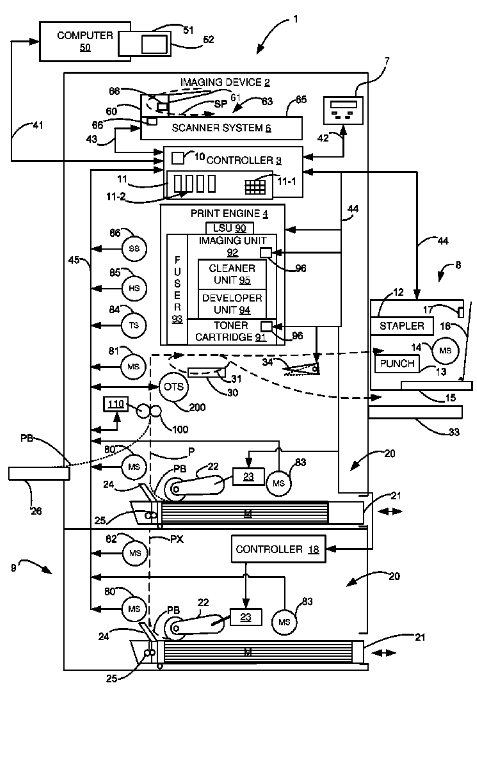
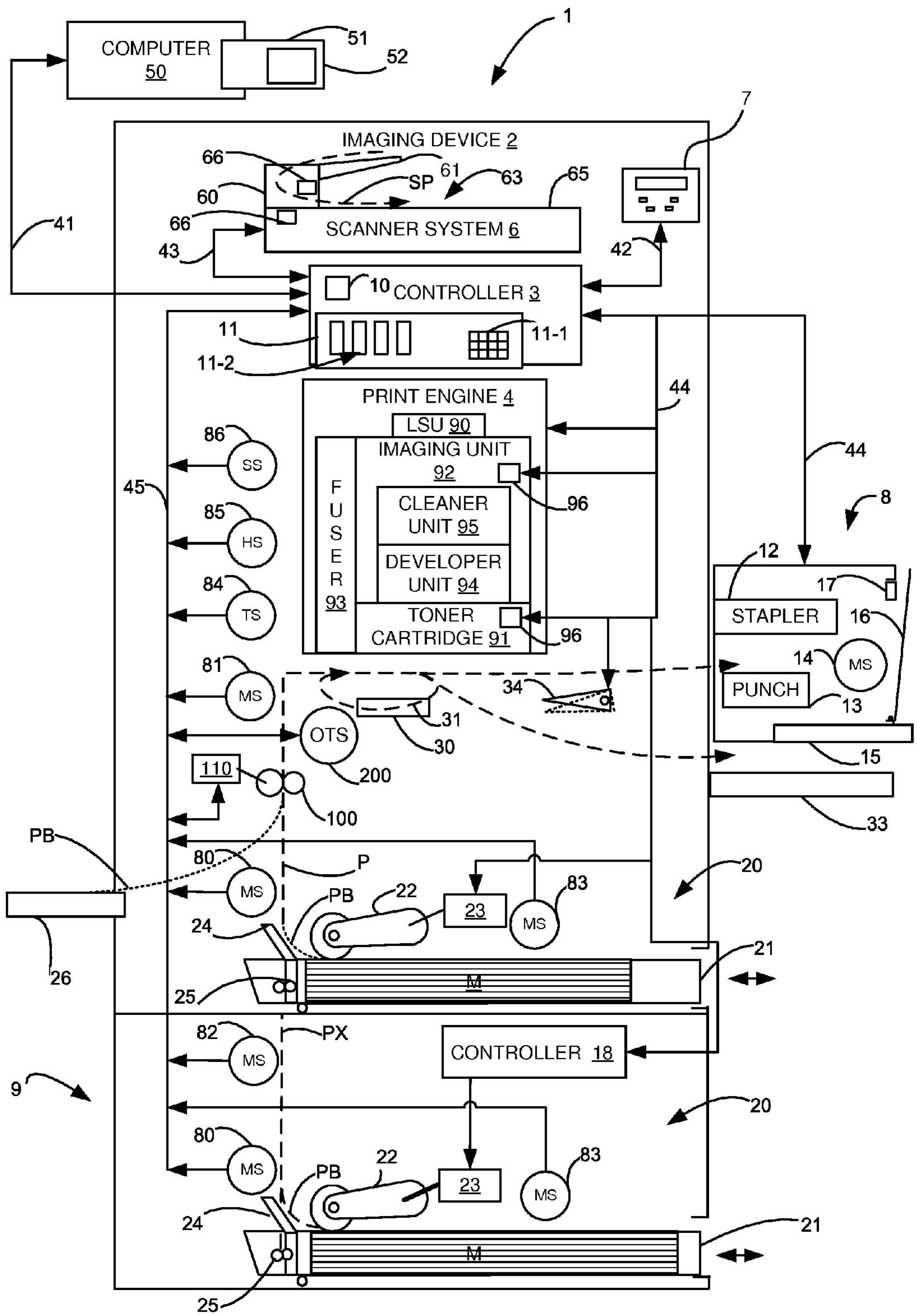
(57) **ABSTRACT**

A method of determining a media class using an optical translucence sensor (OTS) in an imaging device. A media sheet for processing by a media processing device (MPD) in the imaging device passes through an OTS positioned on a media path prior to the MPD. The OTS has an output that is periodically sampled in several predefined interest zones to provide a plurality of intrinsic variables related to the media sheet. The intrinsic variables are combined with extrinsic variables to form a variables data set that is normalized then fed to a controller having a predefined set of media class determining equations for determining a media class for the media sheet. A media class determining equation is provided for each class of media expected to be used in the imaging device. The determined media class is then used to set one or more operating parameters for the media processing device.

17 Claims, 14 Drawing Sheets





COMPUTER 50
51
52
1
IMAGING DEVICE 2
7
66
61
SP
63
65
60
66
SCANNER SYSTEM 6
41
43
42
10
CONTROLLER 3
11
11-1
11-2
PRINT ENGINE 4
44
LSU 90
IMAGING UNIT 92
44
86
SS
96
FUSER 93
CLEANER UNIT 95
8
45
85
HS
DEVELOPER UNIT 94
12
17
84
TS
TONER CARTRIDGE 91
STAPLER
16
96
14
MS
81
MS
PUNCH
34
13
OTS
31
30
200
15
110
100
33
PB
P
80
MS
20
PB
22
23
MS
83
24
26
21
25
M
82
PX
MS
CONTROLLER 18
9
20
80
MS
PB
22
23
83
MS
24
21
M
25

Figure 1

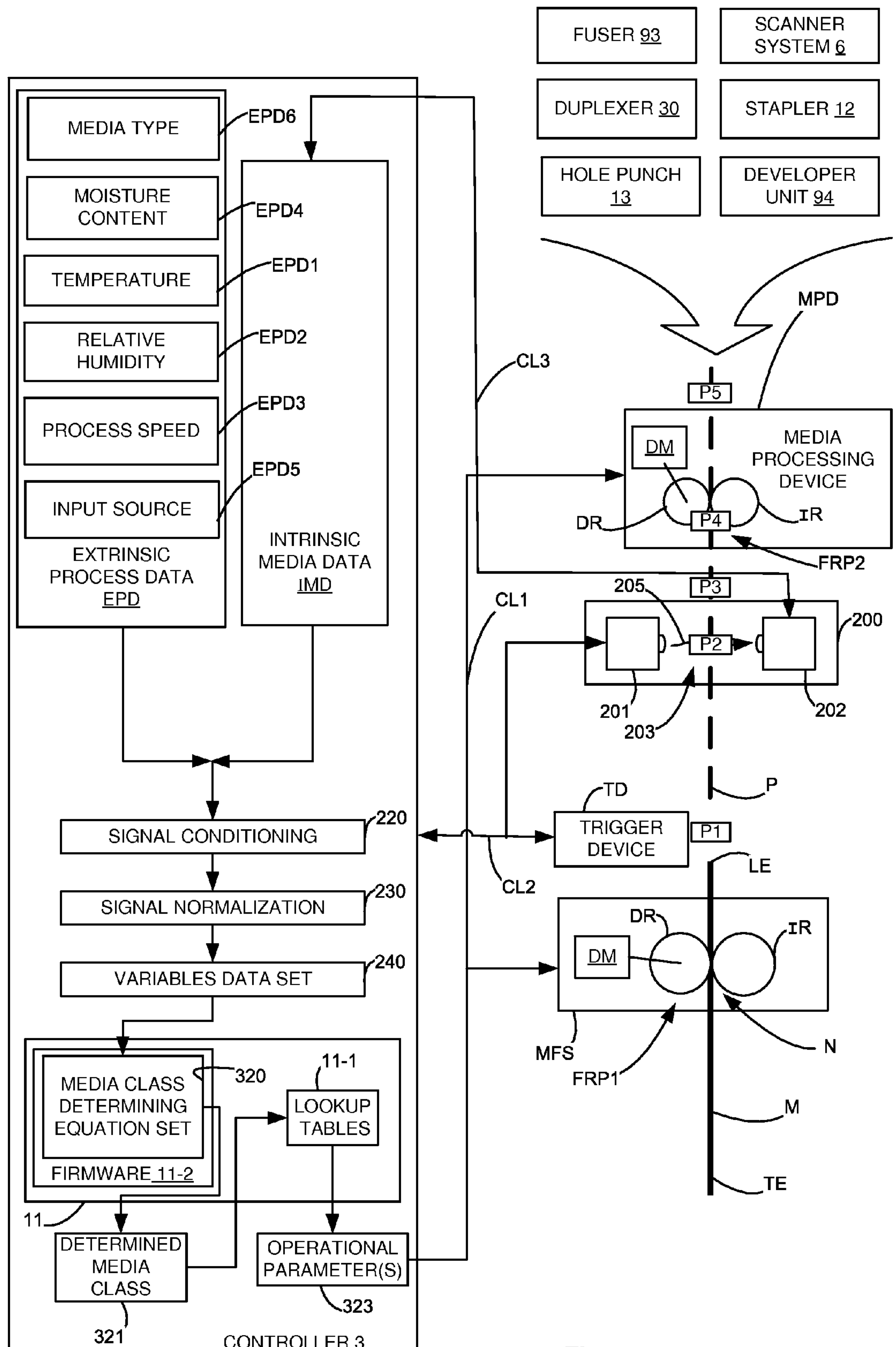

FUSER 93
SCANNER SYSTEM 6
DUPLEXER 30
STAPLER 12
HOLE PUNCH 13
DEVELOPER UNIT 94
MEDIA TYPE
EPD6
MOISTURE CONTENT
EPD4
TEMPERATURE
EPD1
RELATIVE HUMIDITY
EPD2
PROCESS SPEED
EPD3
INPUT SOURCE
EPD5
EXTRINSIC PROCESS DATA EPD
INTRINSIC MEDIA DATA IMD
MPD
CL3
P5
DM
MEDIA PROCESSING DEVICE
DR
P4
IR
FRP2
205
P3
CL1
200
P2
201
203
202
P
TD
TRIGGER DEVICE
P1
LE
CL2
SIGNAL CONDITIONING
220
SIGNAL NORMALIZATION
230
VARIABLES DATA SET
240
DR
IR
DM
MFS
FRP1
N
M
TE
MEDIA CLASS DETERMINING EQUATION SET
320
11-1
LOOKUP TABLES
FIRMWARE 11-2
11
DETERMINED MEDIA CLASS
OPERATIONAL PARAMETER(S)
323
321
CONTROLLER 3

Figure 2

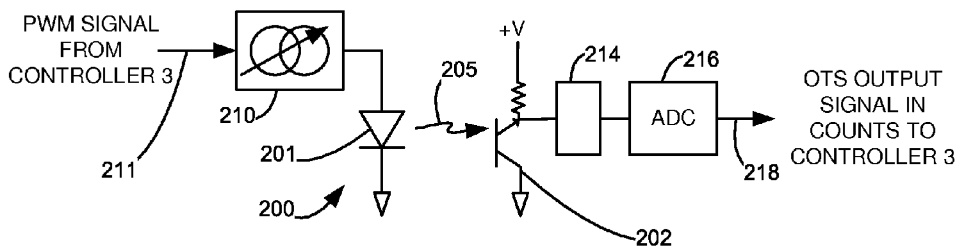


Figure 3

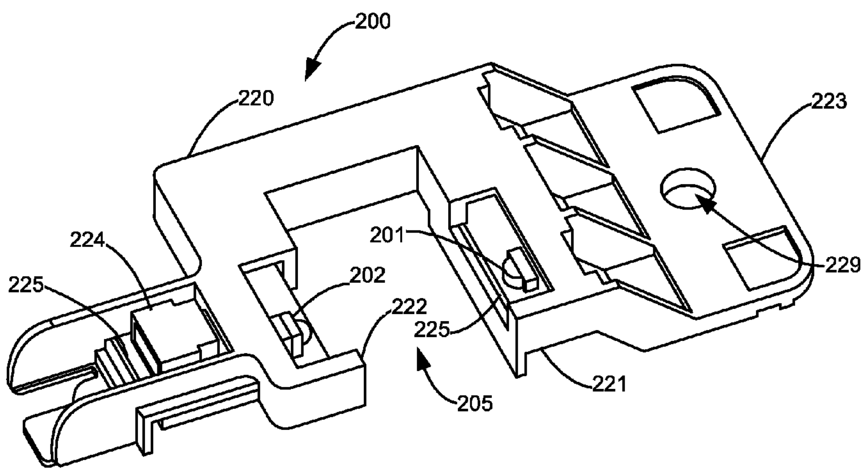


Figure 4

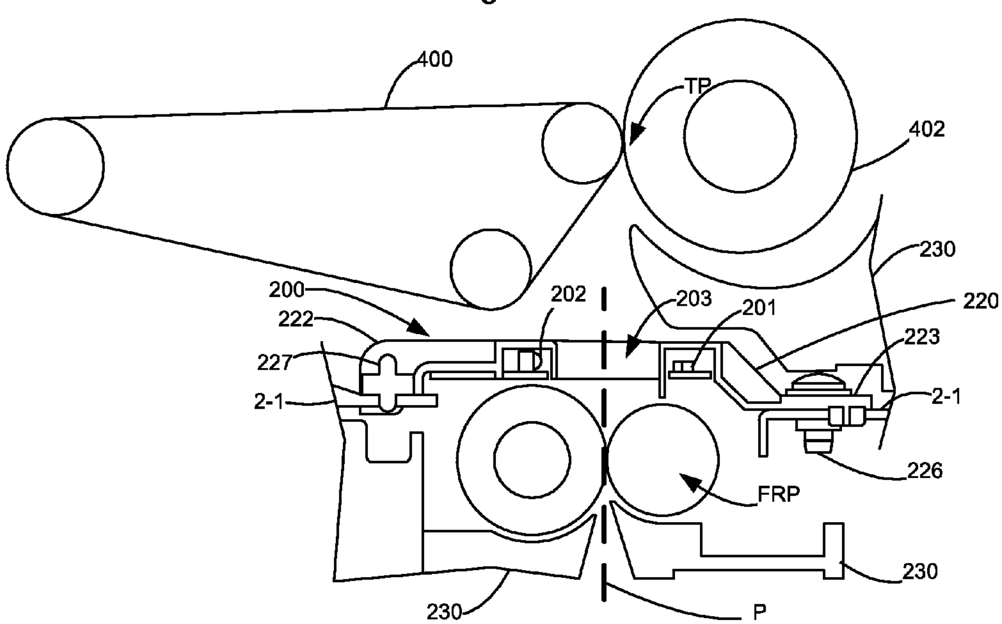


Figure 5

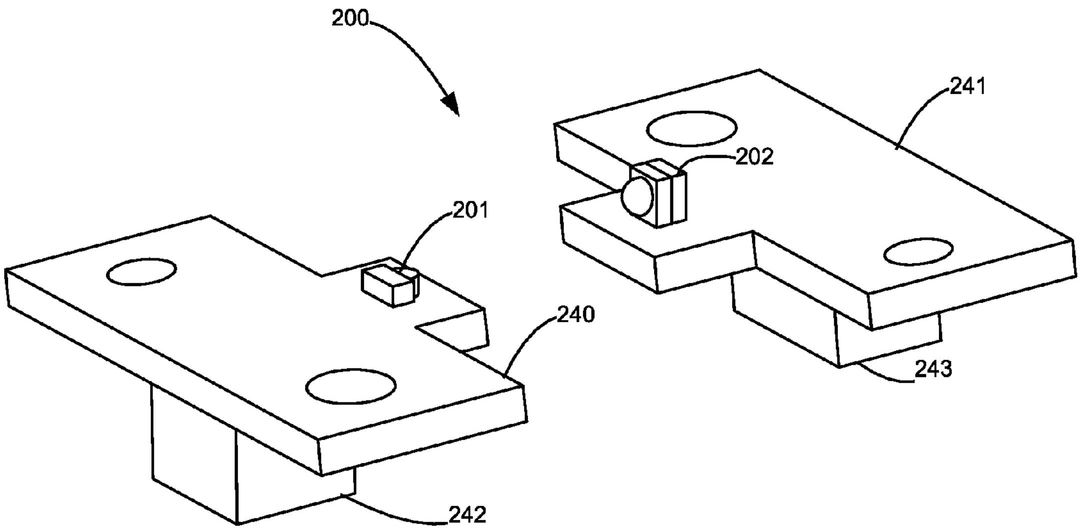


Figure 6

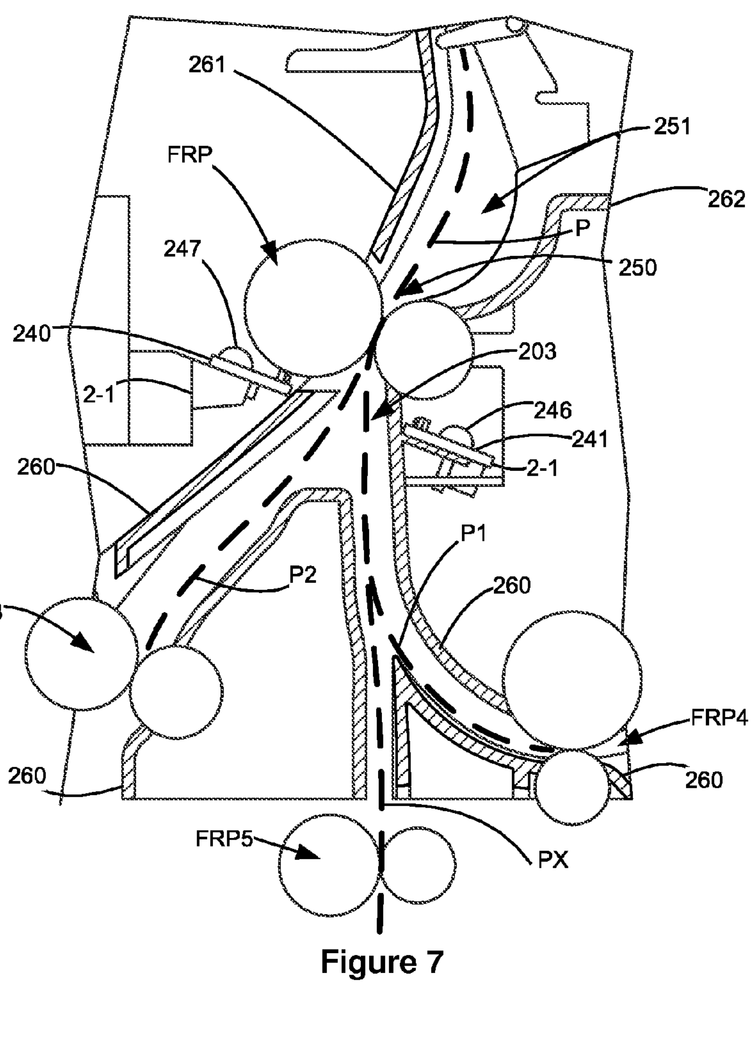


Figure 7

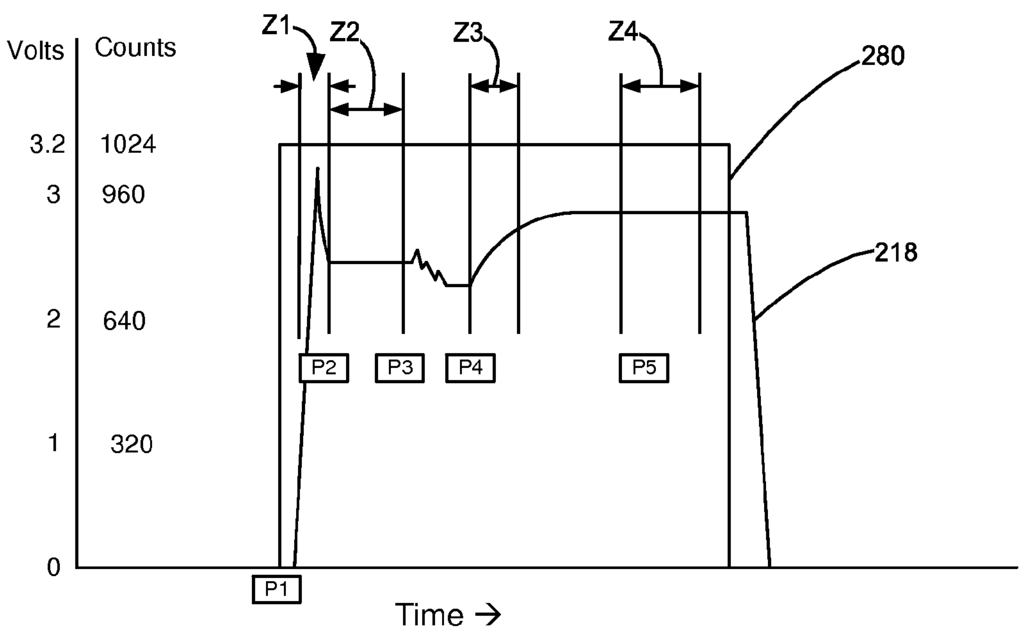

Volts
Counts
Z1
Z2
Z3
Z4
280
218
3.2
1024
3
960
2
640
1
320
0
P1
P2
P3
P4
P5
Time →

Figure 8

Factor	Input Variable	Measure type: Intrinsic Extrinsic	Unit of Measure	Zone	Description
X1	Process Speed	E	PPM	N/A	selected process speed: 25, 40, 50, or 70 pages per minute
X2	Temperature	E	degrees C	N/A	temperature
X3	Relative Humidity	E	%	N/A	relative humidty
X4	Moisture	E	grains	N/A	grains moisture calculated by the engine from temperature and relative humidity
X5	Initial Max	I	ADC counts	1	maximum value reported by the OTS in interest zone 1
X6	First Mean	I	ADC counts	2	mean calculated from all data collected by the OTS in interest zone 2
X7	First Min	I	ADC counts	2	minimum value reported by the OTS in interest zone 2
X8	FirstMax	I	ADC counts	2	maximum value reported by the OTS in interest zone 2
X9	First Range	I	ADC counts	2	First Max - First Min; range of values reported by the OTS in interest zone 2
X10	Second Mean	I	ADC counts	3	mean calculated from all data collected by the OTS in interest zone 3
X11	Second Min	I	ADC counts	3	minimum value reported by the OTS in interest zone 3
X12	Second Max	I	ADC counts	3	maximum value reported by the OTS in interest zone 3
X13	Second Range	I	ADC counts	3	Second Max - Second Min ; range of values reported by the OTS in interest zone 3
X14	First Delta First Mean & Initial Maximun	I	ADC counts	1 & 2	Initial Max - First Mean; difference between initial maximum and mean from interest zones 1 & 2
X15	Third Mean	I	ADC counts	4	mean calculated from all data collected by the OTS in interest zone 4
X16	Third Min	I	ADC counts	4	minimum value reported by the OTS in interest zone 4
X17	Third Max	I	ADC counts	4	maximum value reported by the OTS in interest zone 4
X18	Third Range	I	ADC counts	4	Third Max - Third Min ; range of values reported by the OTS in interest zone 4
X19	Second Delta First Mean Second Mean	I	ADC counts	2 & 3	First Mean - Second Mean; difference between the means from the interest zones 2 & 3
X20	Third Delta First Mean Third Mean	I	ADC counts	2 & 4	First Mean - Third Mean; difference between the means from interest zones 3 & 4
X21	Fourth Delta Second Mean Third Mean	I	ADC counts	3 & 4	Second Mean - Third Mean; difference between the means from the interest zones 3 & 4
X22	Input Source	E	source	N/A	selected input source: 1 = input media tray 1, 2 = manual media feed tray, 3 = other

Figure 9

-0.31351	x1	-0.61607	x1*x12	0.668023	x1*x19	-0.04394	x7*x18	-0.85538	x14*x18
2.507055	x2	0.144997	x2*x11	-0.04971	x2*x18	0.075328	x8*x17	0.13487	x15*x17
-1.37206	x3	0.383066	x3*x10	-0.20656	x3*x17	-0.15312	x9*x16	0.074819	x12*x21
-0.42903	x4	-0.00575	x4*x9	-0.16425	x4*x16	0.075464	x10*x15	-0.03922	x13*x20
1.512722	x5	-0.17555	x5*x8	-0.1757	x5*x15	-0.21998	x11*x14	-1.93116	x14*x19
-0.90759	x6	0.245223	x6*x7	-1.03963	x6*x14	-0.69191	x12*x13	-0.26622	x15*x18
-0.49354	x7	-0.18069	x1*x13	-0.12127	x7*x13	0.480723	x5*x21	0.183027	x16*x17
-0.39329	x8	0.176559	x2*x12	0.143545	x8*x12	0.697906	x6*x20	-0.5029	x13*x21
0.400408	x9	0.262895	x3*x11	-0.11605	x9*x11	0.235069	x7*x19	-1.90495	x14*x20
-0.46231	x10	-0.09474	x4*x10	0.082287	x1*x20	-0.01849	x8*x18	-0.40933	x15*x19
-0.87184	x11	-0.35985	x5*x9	-1.29226	x2*x19	-0.09664	x9*x17	-0.23034	x16*x18
-0.73143	x12	0.272021	x6*x8	0.974773	x3*x18	0.138596	x10*x16	0.038928	x14*x21
2.261732	x13	0.623572	x1*x14	-0.12712	x4*x17	0.020188	x11*x15	-0.41765	x15*x20
4.701306	x14	-0.07973	x2*x13	-0.10608	x5*x16	-0.23086	x12*x14	-0.42338	x16*x19
-0.26387	x15	0.301394	x3*x12	-0.1714	x6*x15	0.46107	x6*x21	-0.18256	x17*x18
-0.24377	x16	-0.21123	x4*x11	-0.98092	x7*x14	0.616889	x7*x20	0.007261	x15*x21
-0.02621	x17	0.094519	x5*x10	-0.08447	x8*x13	0.241969	x8*x19	-0.40307	x16*x20
1.4776	x18	-0.07561	x6*x9	-0.12629	x9*x12	-0.01165	x9*x18	-0.40355	x17*x19
-0.70134	x19	0.355495	x7*x8	0.091514	x10*x11	0.173132	x10*x17	0.034963	x16*x21
-1.21459	x20	-0.06466	x1*x15	-0.55524	x1*x21	0.087572	x11*x16	-0.38341	x17*x20
-0.4746	x21	0.568531	x2*x14	-2.70147	x2*x20	0.012733	x12*x15	0.354608	x18*x19
1.059324	x1*x2	0.134914	x3*x13	0.956418	x3*x19	-0.81758	x13*x14	0.036373	x17*x21
-1.68992	x1*x3	-0.16927	x4*x12	-0.55838	x4*x18	0.395639	x7*x21	0.459622	x18*x20
-0.08602	x1*x4	-0.03341	x5*x11	-0.04739	x5*x17	0.634772	x8*x20	0.137323	x18*x21
0.129291	x2*x3	0.078133	x6*x10	-0.11455	x6*x16	0.119428	x9*x19	1.322013	x19*x20
0.294796	x1*x5	0.206996	x7*x9	-0.04809	x7*x15	-0.18233	x10*x18	0.799797	x19*x21
-0.6568	x2*x4	-0.01562	x1*x16	-0.97052	x8*x14	0.110016	x11*x17	0.910527	x20*x21
-0.05574	x1*x6	0.970913	x2*x15	-0.19866	x9*x13	0.081349	x12*x16	0.357744	x1^2
-0.0871	x2*x5	-2.11071	x3*x14	0.068401	x10*x12	-0.18995	x13*x15	-2.80973	x2^2
1.704583	x3*x4	0.103049	x4*x13	-1.38343	x2*x21	0.407746	x8*x21	0.364877	x3^2
0.398132	x1*x7	-0.0513	x5*x12	2.216671	x3*x20	0.393661	x9*x20	1.978925	x4^2
-0.4034	x2*x6	0.041397	x6*x11	-0.04531	x4*x19	-0.00744	x10*x19	-0.51039	x5^2
-0.21063	x3*x5	0.168279	x7*x10	-0.44974	x5*x18	-0.3897	x11*x18	0.081017	x6^2
0.43982	x1*x8	0.219258	x8*x9	-0.07152	x6*x17	0.107229	x12*x17	0.157648	x7^2
-0.28291	x2*x7	0.052826	x1*x17	0.006547	x7*x16	-0.15985	x13*x16	0.198652	x8^2
0.836272	x3*x6	0.941626	x2*x16	-0.02956	x8*x15	-0.07968	x14*x15	-0.08756	x9^2
-0.68661	x4*x5	-0.26248	x3*x15	-0.58968	x9*x14	0.29755	x9*x21	0.0612	x10^2
-0.01686	x1*x9	-1.09786	x4*x14	-0.43198	x10*x13	0.035899	x10*x20	0.036921	x11^2
-0.21525	x2*x8	-0.61254	x5*x13	0.037759	x11*x12	-0.02095	x11*x19	0.001312	x12^2
0.867649	x3*x7	0.0281	x6*x12	1.278382	x3*x21	-0.38569	x12*x18	-0.23467	x13^2
-0.14052	x4*x6	0.127362	x7*x11	-0.02115	x4*x20	-0.1098	x13*x17	-0.48536	x14^2
-0.32348	x1*x10	0.194027	x8*x10	-0.71048	x5*x19	-0.05372	x14*x16	0.025972	x15^2
0.48668	x2*x9	-0.39772	x1*x18	-0.03458	x6*x18	0.057885	x10*x21	0.074786	x16^2
0.904927	x3*x8	1.03624	x2*x17	0.048187	x7*x17	0.072083	x11*x20	0.110908	x17^2
-0.16606	x4*x7	-0.31902	x3*x16	0.029644	x8*x16	0.001871	x12*x19	-0.14181	x18^2
-0.32019	x5*x6	-0.12092	x4*x15	-0.25844	x9*x15	-0.30607	x13*x18	0.260937	x19^2
-0.62348	x1*x11	-1.50069	x5*x14	-0.03849	x10*x14	-0.02357	x14*x17	1.117484	x20^2
0.298554	x2*x10	-0.22151	x6*x13	-0.6899	x11*x13	0.10179	x15*x16	0.054322	x21^2
0.217654	x3*x9	0.119187	x7*x12	0.041141	x4*x21	0.107052	x11*x21	-1.29077	K
-0.13915	x4*x8	0.149931	x8*x11	-0.25048	x5*x20	0.061551	x12*x20		
-0.20804	x5*x7	-0.086	x9*x10	0.251224	x6*x19	0.486391	x13*x19		

Figure 10

-0.5347253	x1	0.5025446	x1*x12	-0.4734942	x1*x19	0.0866632	x7*x18	0.46694	x14*x18
-3.518768	x2	-0.4786248	x2*x11	-0.0353132	x2*x18	-0.2554621	x8*x17	0.099005	x15*x17
1.0354086	x3	-0.5001706	x3*x10	-0.0253304	x3*x17	-0.0451297	x9*x16	-0.1115774	x12*x21
1.2312645	x4	0.4572097	x4*x9	0.7939836	x4*x16	0.0306121	x10*x15	0.0620817	x13*x20
-0.1723424	x5	-0.0219797	x5*x8	0.0276302	x5*x15	0.262312	x11*x14	2.4682169	x14*x19
1.4685478	x6	-0.7423997	x6*x7	1.3115312	x6*x14	0.58043	x12*x13	-0.1619001	x15*x18
1.323039	x7	0.0649606	x1*x13	0.183616	x7*x13	-0.5467967	x5*x21	0.125866	x16*x17
1.3270526	x8	-0.4615651	x2*x12	-0.5503528	x8*x12	-1.1521604	x6*x20	0.5204402	x13*x21
-0.0297448	x9	-0.4152918	x3*x11	0.1069722	x9*x11	-0.6958022	x7*x19	2.3833862	x14*x20
1.0329805	x10	0.7160661	x4*x10	0.4147917	x1*x20	0.0701385	x8*x18	0.0358772	x15*x19
1.1171191	x11	0.2302395	x5*x9	0.9887318	x2*x19	-0.143812	x9*x17	-0.1904793	x16*x18
1.1087524	x12	-0.7045259	x6*x8	-0.0562685	x3*x18	0.03508	x10*x16	-0.1018103	x14*x21
-1.0543338	x13	-0.5216289	x1*x14	0.7238485	x4*x17	-0.1787521	x11*x15	-0.2690089	x15*x20
-2.9983823	x14	0.2509984	x2*x13	0.0195454	x5*x16	0.264021	x12*x14	0.0296555	x16*x19
0.8036119	x15	-0.4248268	x3*x12	0.0408321	x6*x15	-0.4993218	x6*x21	-0.3073887	x17*x18
0.7853242	x16	0.7963076	x4*x11	1.5075412	x7*x14	-1.1161744	x7*x20	-0.3510698	x15*x21
0.5092372	x17	-0.2229097	x5*x10	0.1547534	x8*x13	-0.6760005	x8*x19	-0.316162	x16*x20
-0.0286478	x18	0.2681851	x6*x9	0.1173559	x9*x12	-0.0710909	x9*x18	0.0203517	x17*x19
0.8339673	x19	-0.8927208	x7*x8	-0.2298873	x10*x11	-0.0736342	x10*x17	-0.3910549	x16*x21
1.3100619	x20	-0.0346605	x1*x15	0.8148391	x1*x21	-0.1827022	x11*x16	-0.3209248	x17*x20
0.3891073	x21	-0.1526316	x2*x14	2.8023346	x2*x20	-0.1519724	x12*x15	0.0522724	x18*x19
-1.4469283	x1*x2	0.2547154	x3*x13	-1.5360453	x3*x19	0.2991483	x13*x14	-0.3879737	x17*x21
1.3194647	x1*x3	0.7483693	x4*x12	0.3373439	x4*x18	-0.4638369	x7*x21	-0.028465	x18*x20
0.377928	x1*x4	-0.3544384	x5*x11	-0.1406437	x5*x17	-1.1021359	x8*x20	-0.1109614	x18*x21
-1.1947061	x2*x3	-0.18649	x6*x10	0.0415394	x6*x16	0.2951043	x9*x19	-1.4617631	x19*x20
-0.1804629	x1*x5	0.0242249	x7*x9	-0.171725	x7*x15	-0.2232549	x10*x18	-0.8286904	x19*x21
1.9366332	x2*x4	-0.0820679	x1*x16	1.4973978	x8*x14	-0.2731402	x11*x17	-0.2905653	x20*x21
0.157613	x1*x6	-1.3434551	x2*x15	0.0337505	x9*x13	-0.156398	x12*x16	0.6061243	x1^2
-0.0737582	x2*x5	1.7483641	x3*x14	-0.1872081	x10*x12	-0.0845995	x13*x15	3.6720872	x2^2
-2.8382707	x3*x4	-0.3162676	x4*x13	1.7508788	x2*x21	-0.4713138	x8*x21	-1.3118808	x3^2
-0.0705252	x1*x7	-0.3200665	x5*x12	-2.6045204	x3*x20	0.1258141	x9*x20	-1.697795	x4^2
0.0850192	x2*x6	-0.4248664	x6*x11	-0.3343929	x4*x19	-0.3746568	x10*x19	0.2744719	x5^2
-0.4132497	x3*x5	-0.3819428	x7*x10	0.0240036	x5*x18	0.0898472	x11*x18	-0.2736677	x6^2
-0.1067082	x1*x8	0.0585016	x8*x9	-0.0705413	x6*x17	-0.2526246	x12*x17	-0.4588567	x7^2
0.1341576	x2*x7	-0.2413136	x1*x17	-0.1713017	x7*x16	-0.0961071	x13*x16	-0.432726	x8^2
-1.2519354	x3*x6	-1.2437925	x2*x16	-0.1412848	x8*x15	0.101122	x14*x15	0.2242653	x9^2
0.8604119	x4*x5	0.0306024	x3*x15	-0.0116248	x9*x14	-0.2042062	x9*x21	0.0052379	x10^2
-0.166463	x1*x9	0.6493529	x4*x14	0.1828604	x10*x13	-0.4121317	x10*x20	-0.2451254	x11^2
0.0872914	x2*x8	0.0752633	x5*x13	-0.4277524	x11*x12	-0.3686359	x11*x19	-0.1831661	x12^2
-1.1638676	x3*x7	-0.3889601	x6*x12	-1.1123555	x3*x21	0.0816858	x12*x18	0.1224222	x13^2
0.5669481	x4*x6	-0.6241516	x7*x11	-0.3676313	x4*x20	-0.1972006	x13*x17	-0.0562383	x14^2
0.3825404	x1*x10	-0.3550714	x8*x10	0.5301115	x5*x19	0.0821598	x14*x16	0.0924579	x15^2
-0.5661885	x2*x9	0.3115661	x1*x18	-0.16958	x6*x18	-0.0811193	x10*x21	0.1173133	x16^2
-1.2337774	x3*x8	-1.4150565	x2*x17	-0.2689335	x7*x17	-0.468388	x11*x20	0.0030797	x17^2
0.6202403	x4*x7	0.0672072	x3*x16	-0.1524077	x8*x16	-0.3858286	x12*x19	-0.0947005	x18^2
0.0429469	x5*x6	0.7253114	x4*x15	0.1952805	x9*x15	0.1493785	x13*x18	-0.3171898	x19^2
0.4438138	x1*x11	1.1991242	x5*x14	0.0512121	x10*x14	-0.0102722	x14*x17	-0.8780666	x20^2
-0.4293907	x2*x10	-0.0256547	x6*x13	0.5846626	x11*x13	0.2089726	x15*x16	0.2716121	x21^2
-0.6183864	x3*x9	-0.5781979	x7*x12	-0.0742216	x4*x21	-0.1426387	x11*x21	-0.109189	K
0.5908904	x4*x8	-0.5953634	x8*x11	0.0360831	x5*x20	-0.452938	x12*x20		
-0.0532447	x5*x7	0.0979207	x9*x10	-0.6971337	x6*x19	-0.4896781	x13*x19		

Figure 11

1.4761343	x1	0.0585336	x1*x12	-0.2812825	x1*x19	-0.2487212	x7*x18	0.3396	x14*x18
1.566007	x2	-0.2602918	x2*x11	0.270479	x2*x18	-0.2375475	x8*x17	-0.4856434	x15*x17
1.2480825	x3	0.6827567	x3*x10	0.6984474	x3*x17	0.2756962	x9*x16	-0.2230391	x12*x21
0.1463263	x4	-0.1056412	x4*x9	-0.4026578	x4*x16	-0.3816848	x10*x15	-0.0403658	x13*x20
0.2657739	x5	-0.411318	x5*x8	-0.1130784	x5*x15	-0.3466091	x11*x14	-0.1855512	x14*x19
1.5497877	x6	0.0310789	x6*x7	-0.3983793	x6*x14	0.1341094	x12*x13	0.3569222	x15*x18
0.6526111	x7	0.0480581	x1*x13	-0.0731313	x7*x13	-0.0692802	x5*x21	-0.554635	x16*x17
0.5721877	x8	-0.2451384	x2*x12	-0.2660786	x8*x12	0.4309148	x6*x20	0.0961335	x13*x21
0.2013526	x9	0.6608762	x3*x11	-0.1679441	x9*x11	0.6697426	x7*x19	0.1119494	x14*x20
1.3057239	x10	-0.2912947	x4*x10	-0.2172586	x1*x20	-0.2753022	x8*x18	0.8400813	x15*x19
1.4734733	x11	0.0932791	x5*x9	-0.1349371	x2*x19	0.3463364	x9*x17	0.3104803	x16*x18
1.3788831	x12	-0.0315638	x6*x8	-1.0417481	x3*x18	-0.442277	x10*x16	0.3067986	x14*x21
-1.7298405	x13	0.4497996	x1*x14	-0.3379155	x4*x17	-0.2455896	x11*x15	1.1751273	x15*x20
-2.6452983	x14	0.5979576	x2*x13	-0.1589167	x5*x16	-0.329836	x12*x14	0.8712066	x16*x19
1.0853027	x15	0.6391732	x3*x12	0.1069889	x6*x15	-0.220116	x6*x21	0.4145532	x17*x18
1.0967502	x16	-0.3066152	x4*x11	-0.7637184	x7*x14	0.4621084	x7*x20	0.3665429	x15*x21
1.2415068	x17	-0.182968	x5*x10	-0.0846671	x8*x13	0.6413245	x8*x19	1.2214281	x16*x20
-1.4817388	x18	-0.2705359	x6*x9	-0.1292464	x9*x12	0.0542709	x9*x18	0.8658563	x17*x19
0.2596005	x19	-0.3867501	x7*x8	-0.3815642	x10*x11	-0.321836	x10*x17	0.3816872	x16*x21
0.7514138	x20	-0.0882063	x1*x15	0.127831	x1*x21	-0.298694	x11*x16	1.2113458	x17*x20
0.5490415	X21	0.692702	x2*x14	-0.7886372	x2*x20	-0.2194117	x12*x15	-0.4909444	x18*x19
0.7838945	x1*x2	-0.3084363	x3*x13	-0.2142786	x3*x19	0.5229489	x13*x14	0.3767576	x17*x21
1.0275024	x1*x3	-0.3322975	x4*x12	0.4271674	x4*x18	-0.1777915	x7*x21	-0.5461704	x18*x20
-0.5135873	x1*x4	-0.0534304	x5*x11	-0.0014347	x5*x17	0.4166365	x8*x20	-0.0585364	x18*x21
2.2062834	x2*x3	-0.0254578	x6*x10	0.0615958	x6*x16	-0.475737	x9*x19	-0.3278784	x19*x20
0.1480534	x1*x5	-0.7373684	x7*x9	-0.2645682	x7*x15	0.3216104	x10*x18	0.0528512	x19*x21
-1.5233565	x2*x4	-0.0999241	x1*x16	-0.7722766	x8*x14	-0.1886401	x11*x17	-1.1831698	x20*x21
-0.0915133	x1*x6	0.0489577	x2*x15	0.2912603	x9*x13	-0.2765477	x12*x16	-1.7675314	x1^2
0.0433662	x2*x5	1.1332927	x3*x14	-0.3512555	x10*x12	0.2402829	x13*x15	-2.3200719	x2^2
-0.4531	x3*x4	-0.4436907	x4*x13	-0.620649	x2*x21	-0.1943086	x8*x21	-0.9005087	x3^2
-0.5217946	x1*x7	-0.0163663	x5*x12	-0.1188999	x3*x20	-0.8162439	x9*x20	-0.5593797	x4^2
-0.3229729	x2*x6	0.1142759	x6*x11	-0.3915179	x4*x19	0.8618742	x10*x19	0.1003794	x5^2
1.1566844	x3*x5	-0.3752947	x7*x10	0.2684069	x5*x18	0.1407221	x11*x18	0.1936346	x6^2
-0.5438953	x1*x8	-0.7717071	x8*x9	0.1798816	x6*x17	-0.161837	x12*x17	-0.1511314	x7^2
-0.8559005	x2*x7	0.0533807	x1*x17	-0.3071233	x7*x16	0.1588272	x13*x16	-0.2371595	x8^2
0.584928	x3*x6	-0.0181013	x2*x16	-0.3058421	x8*x15	-0.4548159	x14*x15	-0.0567636	x9^2
-0.3668311	x4*x5	0.6521654	x3*x15	0.7164721	x9*x14	-0.3299949	x9*x21	-0.2621163	x10^2
-0.1941345	x1*x9	0.2290025	x4*x14	0.2729841	x10*x13	0.5876566	x10*x20	-0.1152095	x11^2
-0.8518788	x2*x8	0.4965802	x5*x13	-0.2085232	x11*x12	0.8563604	x11*x19	-0.0922397	x12^2
0.352899	x3*x7	0.1421867	x6*x12	0.1154175	x3*x21	0.1647211	x12*x18	0.1592989	x13^2
-0.4844198	x4*x6	-0.2244155	x7*x11	-0.124403	x4*x20	0.2462819	x13*x17	0.3468702	x14^2
-0.0411303	x1*x10	-0.4254045	x8*x10	0.5883104	x5*x19	-0.4555658	x14*x16	-0.2702628	x15^2
-0.0011053	x2*x9	0.1115321	x1*x18	0.0866549	x6*x18	-0.2450747	x10*x21	-0.3368206	x16^2
0.4090068	x3*x8	0.1157505	x2*x17	-0.2070313	x7*x17	0.5947599	x11*x20	-0.2134098	x17^2
-0.6806847	x4*x7	0.6995314	x3*x16	-0.3396208	x8*x16	0.850888	x12*x19	0.2758368	x18^2
0.1941933	x5*x6	-0.4019334	x4*x15	0.1110492	x9*x15	0.3323503	x13*x18	-0.1894936	x19^2
0.1030158	x1*x11	-0.0252786	x5*x14	-0.3271981	x10*x14	-0.3783878	x14*x17	-0.7540519	x20^2
-0.3144567	x2*x10	0.2209043	x6*x13	0.104652	x11*x13	-0.6088552	x15*x16	-0.6203511	x21^2
-0.2781463	x3*x9	-0.2119695	x7*x12	0.2803294	x4*x21	-0.2328544	x11*x21	-1.9235055	K
-0.5901435	x4*x8	-0.279085	x8*x11	0.484371	x5*x20	0.5983539	x12*x20		
-0.344672	x5*x7	-0.0673564	x9*x10	0.6810329	x6*x19	-0.12197	x13*x19		

Figure 12

-0.71412	x1	-0.06754	x1*x12	0.3057	x1*x19	0.14981	x7*x18	-0.36487	x14*x18
-0.83091	x2	0.576772	x2*x11	-0.12943	x2*x18	0.350852	x8*x17	0.21359	x15*x17
-0.74917	x3	-0.61463	x3*x10	-0.47541	x3*x17	-0.13963	x9*x16	0.307005	x12*x21
-0.92427	x4	-0.30372	x4*x9	-0.18225	x4*x16	0.252272	x10*x15	-0.03338	x13*x20
-0.27026	x5	0.428521	x5*x8	0.056024	x5*x15	0.13294	x11*x14	-0.44953	x14*x19
-1.64403	x6	0.410301	x6*x7	-0.1088	x6*x14	-0.04689	x12*x13	0.023806	x15*x18
-0.97966	x7	-0.07136	x1*x13	-0.06722	x7*x13	0.280391	x5*x21	0.213525	x16*x17
-0.97599	x8	0.513418	x2*x12	0.639693	x8*x12	0.04334	x6*x20	-0.03491	x13*x21
-0.05478	x9	-0.54802	x3*x11	0.17255	x9*x11	-0.24889	x7*x19	-0.52461	x14*x20
-1.55368	x10	-0.32027	x4*x10	-0.19177	x1*x20	0.166813	x8*x18	-0.55997	x15*x19
-1.41264	x11	-0.20227	x5*x9	0.505246	x2*x19	-0.16818	x9*x17	0.061789	x16*x18
-1.41627	x12	0.406542	x6*x8	0.06295	x3*x18	0.250629	x10*x16	-0.08016	x14*x21
1.324906	x13	-0.26472	x1*x14	-0.21342	x4*x17	0.389354	x11*x15	-0.54656	x15*x20
2.688832	x14	-0.68991	x2*x13	0.052959	x5*x16	0.101222	x12*x14	-0.57026	x16*x19
-1.2113	x15	-0.55974	x3*x12	-0.04549	x6*x15	0.321427	x6*x21	0.023369	x17*x18
-1.2269	x16	-0.261	x4*x11	0.01019	x7*x14	0.057191	x7*x20	0.011864	x15*x21
-1.28017	x17	0.178994	x5*x10	-0.06565	x8*x13	-0.25188	x8*x19	-0.56134	x16*x20
0.709468	x18	0.01321	x6*x9	0.128442	x9*x12	-0.00072	x9*x18	-0.57993	x17*x19
-0.11397	x19	0.86871	x7*x8	0.527148	x10*x11	0.201419	x10*x17	0.007368	x16*x21
-0.74823	x20	0.141753	x1*x15	-0.51923	x1*x21	0.383772	x11*x16	-0.57019	x17*x20
-0.64429	x21	-0.87463	x2*x14	0.635965	x2*x20	0.337315	x12*x15	-0.01067	x18*x19
-0.35584	x1*x2	-0.11903	x3*x13	0.793923	x3*x19	-0.4793	x13*x14	0.008293	x17*x21
-0.68162	x1*x3	-0.2326	x4*x12	-0.18449	x4*x18	0.305183	x7*x21	0.02479	x18*x20
0.202207	x1*x4	0.327286	x5*x11	-0.0178	x5*x17	0.069786	x8*x20	0.037194	x18*x21
-1.12211	x2*x3	0.096685	x6*x10	-0.05205	x6*x16	-0.0367	x9*x19	0.56682	x19*x20
-0.12087	x1*x5	0.479081	x7*x9	0.417603	x7*x15	0.039332	x10*x18	0.011658	x19*x21
0.26426	x2*x4	0.169653	x1*x16	0.002588	x8*x14	0.339344	x11*x17	0.620486	x20*x21
-0.00925	x1*x6	0.364861	x2*x15	-0.17757	x9*x13	0.335485	x12*x16	0.937675	x1^2
0.249768	x2*x5	-0.67261	x3*x14	0.472831	x10*x12	-0.04791	x13*x15	1.397543	x2^2
1.566211	x3*x4	0.643937	x4*x13	0.133804	x2*x21	0.320813	x8*x21	1.865576	x3^2
0.237795	x1*x7	0.25388	x5*x12	0.428586	x3*x20	0.275827	x9*x20	0.258983	x4^2
0.658983	x2*x6	0.242149	x6*x11	0.775121	x4*x19	-0.55546	x10*x19	-0.1096	x5^2
-0.53241	x3*x5	0.552156	x7*x10	-0.1417	x5*x18	0.126966	x11*x18	-0.03	x6^2
0.251872	x1*x8	0.465916	x8*x9	-0.1064	x6*x17	0.288616	x12*x17	0.424659	x7^2
1.039689	x2*x7	0.102209	x1*x17	0.410129	x7*x16	0.024118	x13*x16	0.443625	x8^2
-0.21666	x3*x6	0.370929	x2*x16	0.40856	x8*x15	0.164105	x14*x15	-0.08902	x9^2
0.111206	x4*x5	-0.43012	x3*x15	-0.45868	x9*x14	0.313482	x9*x21	0.195594	x10^2
0.300702	x1*x9	0.032471	x4*x14	-0.06612	x10*x13	-0.24109	x10*x20	0.330053	x11^2
1.018083	x2*x8	-0.30396	x5*x13	0.60863	x11*x12	-0.53689	x11*x19	0.277344	x12^2
-0.10315	x3*x7	0.183938	x6*x12	-0.3604	x3*x21	0.103272	x12*x18	-0.09416	x13^2
0.070862	x4*x6	0.693381	x7*x11	0.454649	x4*x20	-0.01408	x13*x17	-0.19134	x14^2
-0.13035	x1*x10	0.550191	x8*x10	-0.50068	x5*x19	0.171848	x14*x16	0.131254	x15^2
0.124213	x2*x9	-0.13221	x1*x18	0.027136	x6*x18	0.313665	x10*x21	0.130246	x16^2
-0.12947	x3*x8	0.316197	x2*x17	0.36257	x7*x17	-0.22487	x11*x20	0.081608	x17^2
0.231419	x4*x7	-0.4534	x3*x16	0.398982	x8*x16	-0.54379	x12*x19	-0.07981	x18^2
-0.09398	x5*x6	-0.1616	x4*x15	-0.10406	x9*x15	-0.23333	x13*x18	0.277497	x19^2
-0.03534	x1*x11	-0.29574	x5*x14	0.126731	x10*x14	0.137787	x14*x17	0.592909	x20^2
0.42702	x2*x10	-0.07873	x6*x13	-0.01674	x11*x13	0.263116	x15*x16	0.305247	x21^2
0.608625	x3*x9	0.636861	x7*x12	-0.31052	x4*x21	0.311517	x11*x21	-0.54393	K
0.145762	x4*x8	0.697854	x8*x11	-0.21696	x5*x20	-0.23596	x12*x20		
0.435415	x5*x7	0.038078	x9*x10	-0.27888	x6*x19	-0.0053	x13*x19		

Figure 13

0.0862137	x1	0.1225289	x1*x12	-0.218946967	x1*x19	0.05618583	x7*x18	0.413713323	x14*x18
0.2766191	x2	0.01714769	x2*x11	-0.056022335	x2*x18	0.06682927	x8*x17	0.038179193	x15*x17
-0.162257	x3	0.04897431	x3*x10	0.00885333	x3*x17	0.06218192	x9*x16	-0.047207224	x12*x21
-0.02429	x4	-0.0420923	x4*x9	-0.044825333	x4*x16	0.02333645	x10*x15	0.050880457	x13*x20
-1.335897	x5	0.18032408	x5*x8	0.205123183	x5*x15	0.17133593	x11*x14	0.098029249	x14*x19
-0.466714	x6	0.05579621	x6*x7	0.235281043	x6*x14	0.02426398	x12*x13	0.04739353	x15*x18
-0.502454	x7	0.13903036	x1*x13	0.07799692	x7*x13	-0.1450365	x5*x21	0.03221725	x16*x17
-0.529957	x8	0.01672712	x2*x12	0.033193098	x8*x12	-0.0199999	x6*x20	-0.078766965	x13*x21
-0.517232	x9	0.03953873	x3*x11	0.004471896	x9*x11	0.03988373	x7*x19	-0.065779848	x14*x20
-0.322713	x10	-0.0097602	x4*x10	-0.088051672	x1*x20	0.05684492	x8*x18	0.093344322	x15*x19
-0.306115	x11	0.23860231	x5*x9	-0.066776262	x2*x19	0.06229827	x9*x17	0.048551835	x16*x18
-0.339934	x12	0.05752647	x6*x8	0.0602931	x3*x18	0.01797138	x10*x16	-0.163758342	x14*x21
-0.802464	x13	-0.2870222	x1*x14	-0.045389814	x4*x17	0.01479946	x11*x15	0.058089226	x15*x20
-1.746458	x14	-0.0793246	x2*x13	0.192487995	x5*x16	0.19545204	x12*x14	0.09277893	x16*x19
-0.413739	x15	0.04399956	x3*x12	0.069075633	x6*x15	-0.0630592	x6*x21	0.052026146	x17*x18
-0.41141	x16	-0.0174562	x4*x11	0.226902731	x7*x14	-0.0200142	x7*x20	-0.034597806	x15*x21
-0.444364	x17	0.13236464	x5*x10	0.080029705	x8*x13	0.04458724	x8*x19	0.059136979	x16*x20
-0.676681	x18	0.06474728	x6*x9	0.009742609	x9*x12	0.02918653	x9*x18	0.097274568	x17*x19
-0.278253	x19	0.05526561	x7*x8	-0.007210775	x10*x11	0.02091947	x10*x17	-0.032963224	x16*x21
-0.098653	x20	0.04577223	x1*x15	0.131803264	x1*x21	0.01005217	x11*x16	0.063170984	x17*x20
0.1807395	x21	-0.2339758	x2*x14	0.051808809	x2*x20	0.02133609	x12*x15	0.094734816	x18*x19
-0.040451	x1*x2	0.03783243	x3*x13	-1.78823E-05	x3*x19	0.47478043	x13*x14	-0.033449455	x17*x21
0.0245716	x1*x3	-0.0142042	x4*x12	-0.021637164	x4*x18	-0.0591935	x7*x21	0.090223527	x18*x20
0.0194761	x1*x4	0.11399279	x5*x11	0.207273067	x5*x17	-0.0190591	x8*x20	-0.005019399	x18*x21
-0.018756	x2*x3	0.0371297	x6*x10	0.063473864	x6*x16	0.09790894	x9*x19	-0.099191279	x19*x20
-0.14152	x1*x5	0.02706654	x7*x9	0.066782063	x7*x15	0.04464197	x10*x18	-0.035615363	x19*x21
-0.020735	x2*x4	0.0279583	x1*x16	0.242809007	x8*x14	0.01242062	x11*x17	-0.057277324	x20*x21
-0.001106	x1*x6	-0.0412766	x2*x15	0.051211974	x9*x13	0.01611116	x12*x16	-0.134011601	x1^2
-0.132271	x2*x5	-0.0983383	x3*x14	-0.002769035	x10*x12	0.08217173	x13*x15	0.060176396	x2^2
0.0205765	x3*x4	0.01297209	x4*x13	0.119397443	x2*x21	-0.0629366	x8*x21	-0.018063162	x3^2
-0.043607	x1*x7	0.13385684	x5*x12	0.078162871	x3*x20	0.02094208	x9*x20	0.019266028	x4^2
-0.017633	x2*x6	0.02704499	x6*x11	-0.003896197	x4*x19	0.07567922	x10*x19	0.245142242	x5^2
-0.00039	x3*x5	0.03680297	x7*x10	0.299039089	x5*x18	0.03216104	x11*x18	0.029020583	x6^2
-0.041089	x1*x8	0.02803092	x8*x9	0.068587434	x6*x17	0.01861621	x12*x17	0.027681443	x7^2
-0.035035	x2*x7	0.03289805	x1*x17	0.061748953	x7*x16	0.07301247	x13*x16	0.027608637	x8^2
0.0473947	x3*x6	-0.050661	x2*x16	0.068127087	x8*x15	0.26926901	x14*x15	0.009077815	x9^2
0.0818254	x4*x5	0.00983321	x3*x15	0.34351302	x9*x14	-0.0768313	x9*x21	8.40882E-05	x10^2
0.0767563	x1*x9	0.18702958	x4*x14	0.042253835	x10*x13	0.0296648	x10*x20	-0.006639298	x11^2
-0.038248	x2*x8	0.34465321	x5*x13	-0.010112716	x11*x12	0.0701167	x11*x19	-0.003249782	x12^2
0.046466	x3*x7	0.03473583	x6*x12	0.07895254	x3*x21	0.0360067	x12*x18	0.047109067	x13^2
-0.012874	x4*x6	0.02782407	x7*x11	0.058537835	x4*x20	0.07479933	x13*x17	0.386067395	x14^2
0.1124253	x1*x10	0.03625771	x8*x10	0.092734509	x5*x19	0.25527583	x14*x16	0.020578637	x15^2
-0.043599	x2*x9	0.10683413	x1*x18	0.09037097	x6*x18	-0.0453557	x10*x21	0.014474901	x16^2
0.0493114	x3*x8	-0.0531316	x2*x17	0.065207656	x7*x17	0.02641862	x11*x20	0.017813791	x17^2
-0.004914	x4*x7	0.00568157	x3*x16	0.063402697	x8*x16	0.07686353	x12*x19	0.040481856	x18^2
0.1770291	x5*x6	-0.0408659	x4*x15	0.056172857	x9*x15	0.05766861	x13*x18	-0.03175112	x19^2
0.1119905	x1*x11	0.62258534	x5*x14	0.187742558	x10*x14	0.27443882	x14*x17	-0.078274452	x20^2
0.0182733	x2*x10	0.10499793	x6*x13	0.017328016	x11*x13	0.03497687	x15*x16	-0.010829875	x21^2
0.0702538	x3*x9	0.03411994	x7*x12	0.063269505	x4*x21	-0.0430756	x11*x21	0.867397934	K
-0.007362	x4*x8	0.02666294	x8*x11	-0.053022058	x5*x20	0.02899022	x12*x20		
0.1705393	x5*x7	0.01736107	x9*x10	0.043756171	x6*x19	0.13055401	x13*x19		

Figure 14

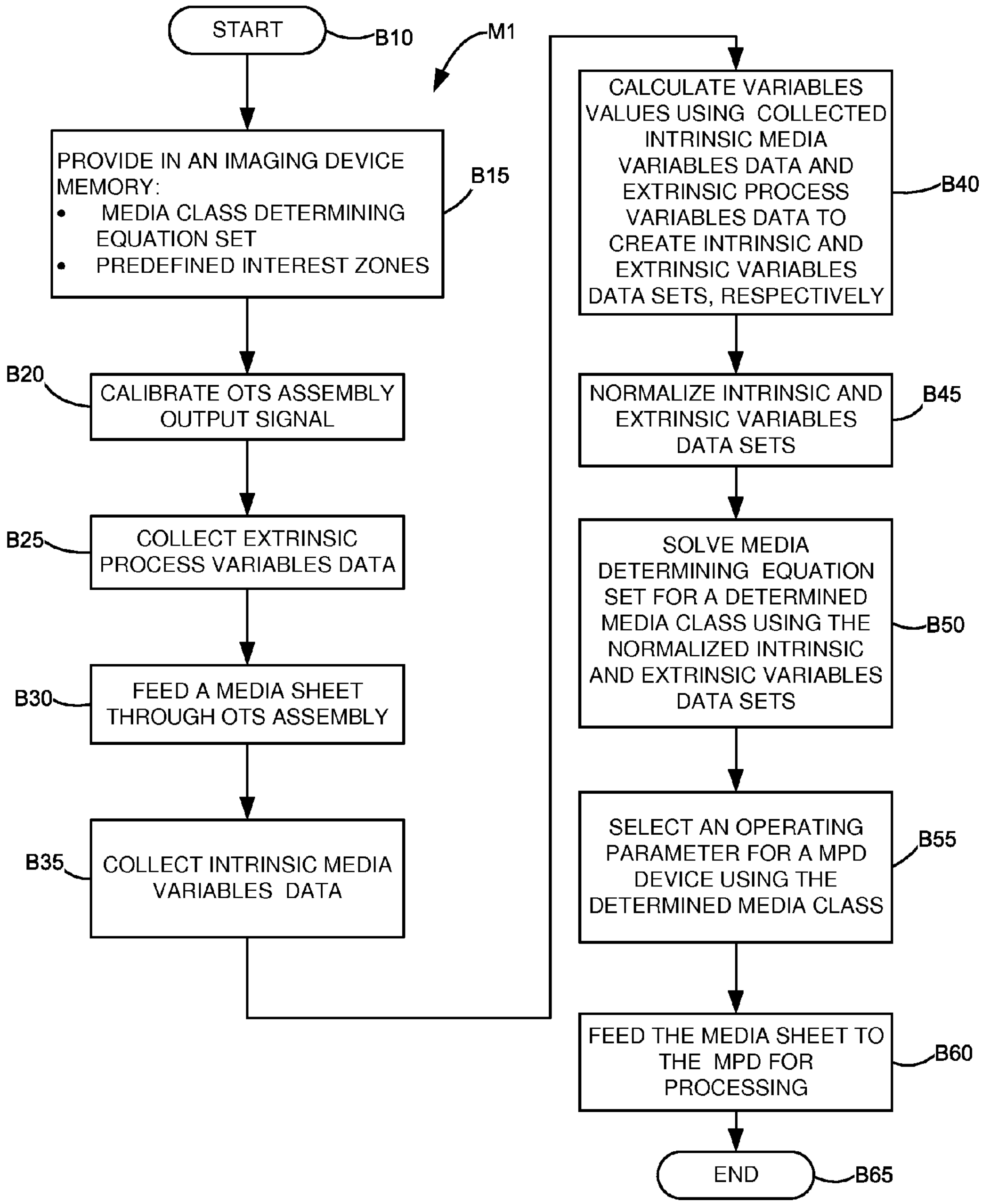

START
B10
M1
PROVIDE IN AN IMAGING DEVICE MEMORY:
• MEDIA CLASS DETERMINING EQUATION SET
• PREDEFINED INTEREST ZONES
B15
B20
CALIBRATE OTS ASSEMBLY OUTPUT SIGNAL
B25
COLLECT EXTRINSIC PROCESS VARIABLES DATA
B30
FEED A MEDIA SHEET THROUGH OTS ASSEMBLY
B35
COLLECT INTRINSIC MEDIA VARIABLES DATA
CALCULATE VARIABLES VALUES USING COLLECTED INTRINSIC MEDIA VARIABLES DATA AND EXTRINSIC PROCESS VARIABLES DATA TO CREATE INTRINSIC AND EXTRINSIC VARIABLES DATA SETS, RESPECTIVELY
B40
NORMALIZE INTRINSIC AND EXTRINSIC VARIABLES DATA SETS
B45
SOLVE MEDIA DETERMINING EQUATION SET FOR A DETERMINED MEDIA CLASS USING THE NORMALIZED INTRINSIC AND EXTRINSIC VARIABLES DATA SETS
B50
SELECT AN OPERATING PARAMETER FOR A MPD DEVICE USING THE DETERMINED MEDIA CLASS
B55
FEED THE MEDIA SHEET TO THE MPD FOR PROCESSING
B60
END
B65

Figure 15

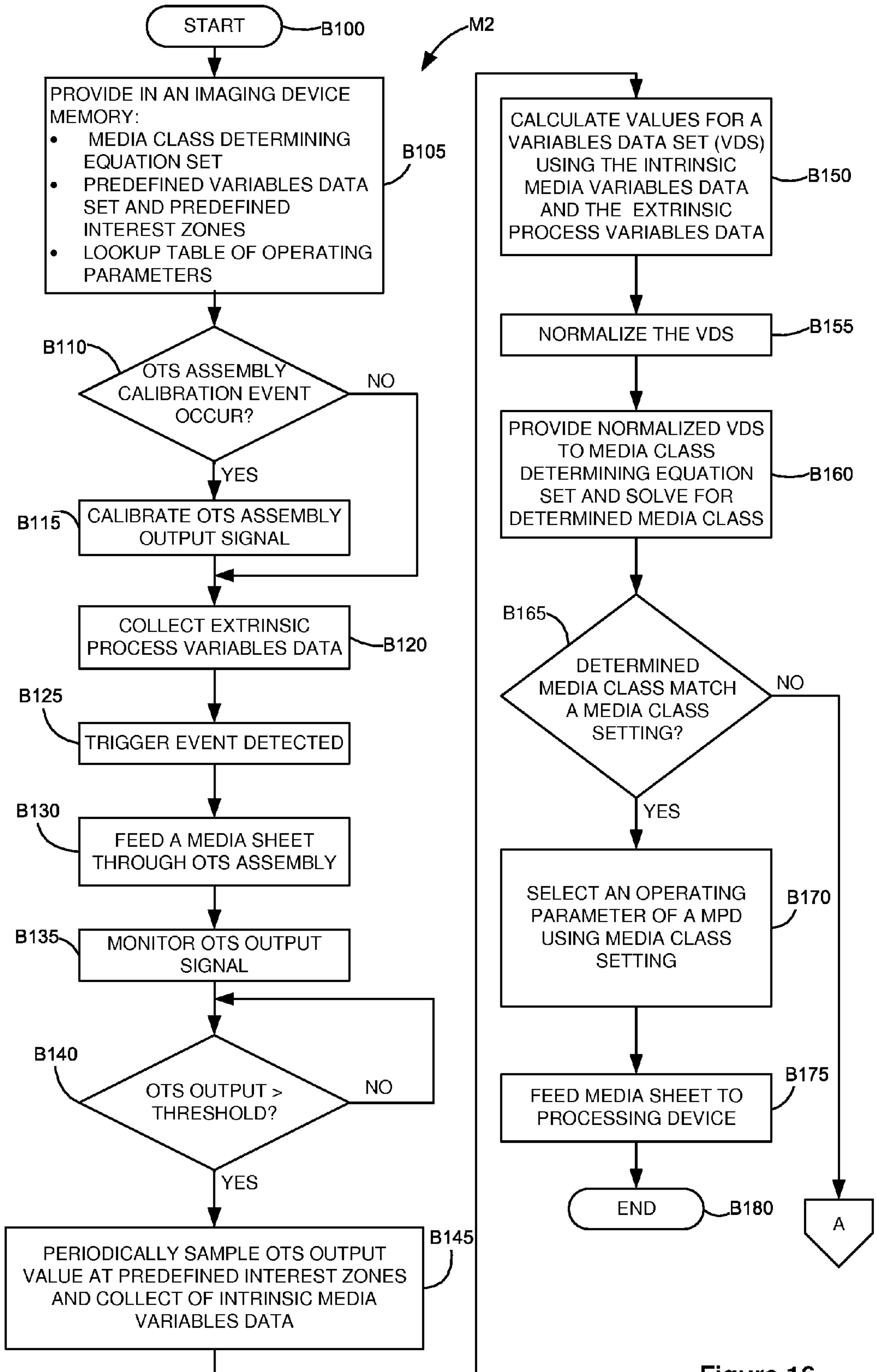

START
B100
M2
PROVIDE IN AN IMAGING DEVICE MEMORY:
• MEDIA CLASS DETERMINING EQUATION SET
• PREDEFINED VARIABLES DATA SET AND PREDEFINED INTEREST ZONES
• LOOKUP TABLE OF OPERATING PARAMETERS
B105
B110
OTS ASSEMBLY CALIBRATION EVENT OCCUR?
NO
YES
B115
CALIBRATE OTS ASSEMBLY OUTPUT SIGNAL
COLLECT EXTRINSIC PROCESS VARIABLES DATA
B120
B125
TRIGGER EVENT DETECTED
B130
FEED A MEDIA SHEET THROUGH OTS ASSEMBLY
B135
MONITOR OTS OUTPUT SIGNAL
B140
OTS OUTPUT > THRESHOLD?
NO
YES
PERIODICALLY SAMPLE OTS OUTPUT VALUE AT PREDEFINED INTEREST ZONES AND COLLECT OF INTRINSIC MEDIA VARIABLES DATA
B145
CALCULATE VALUES FOR A VARIABLES DATA SET (VDS) USING THE INTRINSIC MEDIA VARIABLES DATA AND THE EXTRINSIC PROCESS VARIABLES DATA
B150
NORMALIZE THE VDS
B155
PROVIDE NORMALIZED VDS TO MEDIA CLASS DETERMINING EQUATION SET AND SOLVE FOR DETERMINED MEDIA CLASS
B160
B165
DETERMINED MEDIA CLASS MATCH A MEDIA CLASS SETTING?
NO
YES
SELECT AN OPERATING PARAMETER OF A MPD USING MEDIA CLASS SETTING
B170
FEED MEDIA SHEET TO PROCESSING DEVICE
B175
END
B180
A

Figure 16

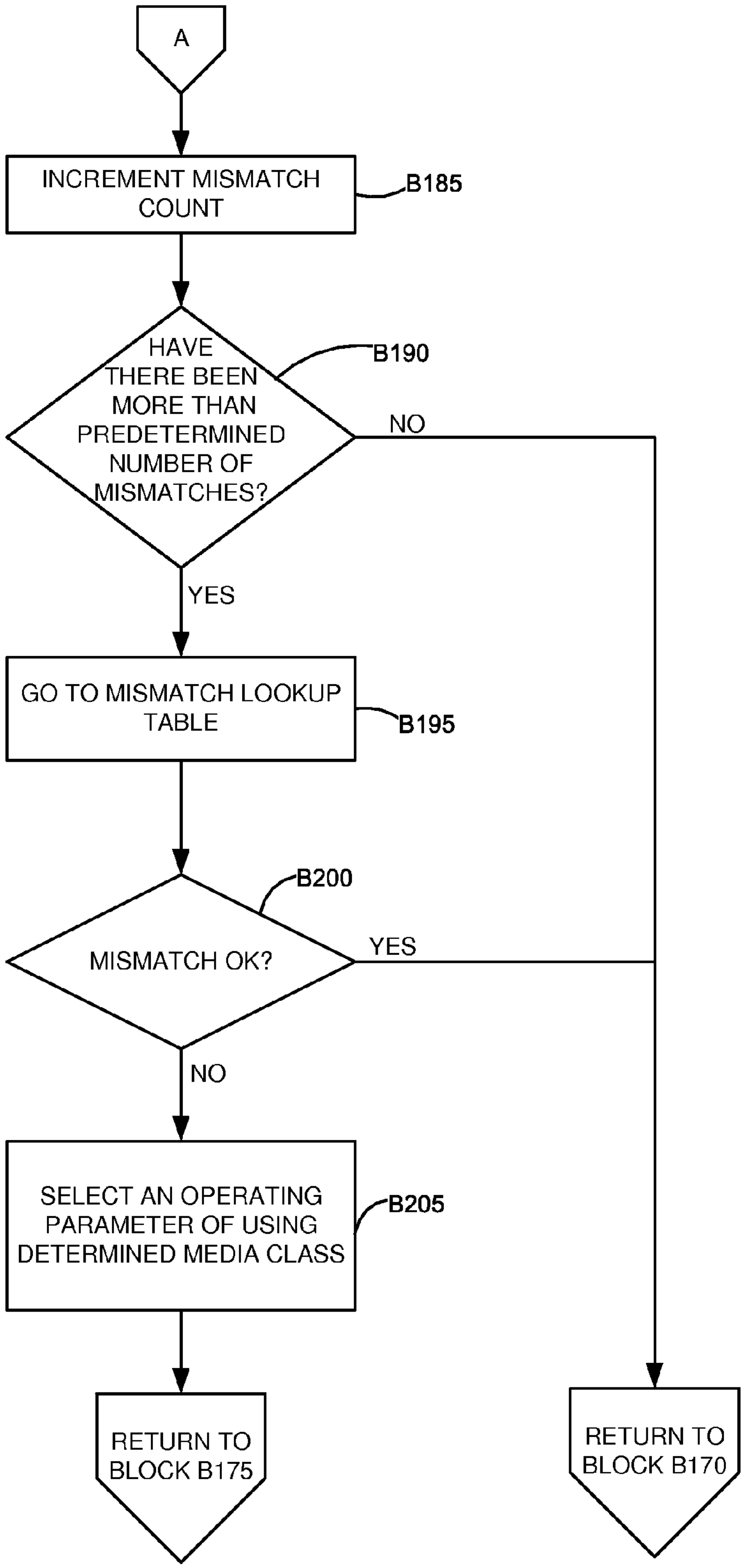

A
INCREMENT MISMATCH COUNT
B185
HAVE THERE BEEN MORE THAN PREDETERMINED NUMBER OF MISMATCHES?
B190
NO
YES
GO TO MISMATCH LOOKUP TABLE
B195
B200
MISMATCH OK?
YES
NO
SELECT AN OPERATING PARAMETER OF USING DETERMINED MEDIA CLASS
B205
RETURN TO BLOCK B175
RETURN TO BLOCK B170

Figure 17

METHOD OF DETERMINING A MEDIA CLASS IN AN IMAGING DEVICE USING AN OPTICAL TRANSLUCENCE SENSOR

CROSS REFERENCES TO RELATED APPLICATIONS

None.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

None.

REFERENCE TO SEQUENTIAL LISTING, ETC.

None.

BACKGROUND

1. Field of the Disclosure

The present disclosure relates generally to imaging device media sensors and methods of using the same, and more particularly to media translucence sensors and methods of using the same.

2. Description of the Related Art

Currently, most imaging devices require the user to input media type, media weight, and texture. However, most users do not adjust media settings. Of those users that do adjust settings, only a small percentage correctly classify media. Failure to correctly set media properties results in print quality defects, poor fuse grade, and higher jam rates. Also, this leads to a higher number of service calls, visits, and replacement part rates.

Incorrectly setting media weight is a major contributor to these higher failure rates. If the media weight is set too low, the printer runs too fast, transfer voltages are set too low, and fuser temperatures are set too low. If the media weight is set too high, the printer runs too slow, transfer voltages are set too high, and fuser temperatures are set too high. Poor print quality is a result along with premature hardware failures.

In particular, light weight media set at a normal or a heavy weight has a much higher likelihood to wrap a fuser, particularly, when printing higher coverage pages. Too much heat is provided and the toner hot offsets. Because the trend is towards using lighter weight media with more refined (recycled) fiber content, this problem will become more prevalent.

Additionally, heavy weight media set at normal or light weight does not adequately melt the toner and cold offset occurs. This allows unattached toner to deposit on the fuser backup roll and be carried downstream where it contaminates paper guides and creates catch points. This results in a higher likelihood for jams, fuser being wrapped by media (fuse wraps), and machine damage on subsequent jobs. Ultimately, if media is run at an improper weight setting, user satisfaction suffers.

For the detection of media class, optical sensors often strike a reasonable balance between cost, performance, speed, and footprint when compared to other alternatives. Perhaps one of the simplest optical sensor embodiments involves using a photo detector, such as a photo-transistor for measuring the intensity of a light beam, emitted by light source such as a LED, passing through a sheet of media. Unfortunately, the analog output provided by the simplest implementation is often too variable to provide much confidence in a media class determination made from a dynamic measurement taken with this sensor arrangement. The amount of transmitted light reaching the photo-transistor is a strong function of LED intensity, wavelength, and several external factors including media composition, media position, media surface roughness, media thickness, and sensor component variability. These external factors are sources of variation that must be accommodated to ensure reliable media class determinations.

Historically, sensor output variation has been addressed through judicious architectural decisions in the structure of an imaging device, the use of media staging algorithms, expensive optics, more complex camera hardware, and/or computationally intense signal processing. These solutions are often costly, unreliable, and/or inefficient.

It would be advantageous to be able to use a simple low cost photodetector and LED sensor to be able to provide dynamic reliable media class determinations of a sheet of media as it is being fed along a media feed path in an imaging device prior to being processed. It would be further advantageous to be able to use a low-cost, space-efficient optical translucency sensor that is capable of classifying media into several different categories with a very high accuracy rate without negatively impacting throughput. It would additionally be desirable to be able to adjust an operating parameter of the imaging device or a subsystem thereof based on the selected media class.

SUMMARY

Disclosed is a method of determining a media class using an optical translucence sensor to provide intrinsic media variables data along with extrinsic process variables data from temperature and humidity sensors. An imaging device uses a media set having predetermined number of a media classes. The imaging device includes a media processing device, a plurality of media input sources, a media feeding system in communication with the media processing device and the plurality of media input sources, an optical translucence sensor (OTS) mounted on a media path between the plurality of media input sources and the media processing device, a temperature sensor, and a relative humidity sensor. The imaging device is operable at a plurality of media process rates with the media feeding system feeding a media sheet to the media processing device for processing. The OTS has an output signal representative of the translucence of the media sheet. The method of determining a media class from the media set comprises:

storing in memory of the imaging device a media class determining equation set incorporating a predetermined plurality of media class determining equations using a predetermined set of variables wherein each equation corresponds to one media class of the media set;

measuring the temperature and relative humidity;

calculating a moisture content value using the measured temperature and relative humidity values;

determining a selected media source from the plurality of media sources;

determining a process rate from the plurality of process rates;

forming an extrinsic variables data including the selected media source, the determined process rate, the calculated moisture content, the measured temperature, and the measured relative humidity;

determining whether or not an OTS calibration event has occurred;

upon determining that an OTS calibration event has occurred performing a calibration of the OTS wherein, with

no media sheet to be processed present therein, the output signal of the OTS is set to a predetermined value by adjusting an input current to the OTS;

feeding the media sheet to be processed into a nip formed between a pair of feed rolls positioned along the media path prior to the OTS;

on the occurrence of a trigger event, feeding the media sheet to be processed through the OTS;

determining whether or not the OTS output signal is greater than a predetermined threshold value

upon determining that the OTS output signal is not above the predetermined threshold value then repeating the action of determining whether or not the OTS output signal value is greater than the predetermined threshold value;

upon determining that the OTS output signal is above the predetermined threshold value periodically measuring the OTS output signal value at a plurality of predefined interest zones as the media sheet to be processed is feed from the nip through the OTS forming an intrinsic variables data;

forming a variables data set from the extrinsic process variables data and the intrinsic media variables data;

normalizing the variables data set;

solving the media class determining equation set using the normalized variables data set to determine for the media sheet to be processed a media class from the media set;

determining whether or not the determined media class matches a selected media class setting for the media processing device;

upon determining that the determined media class matches the selected media class setting:

selecting, based upon the selected media class setting, at least one operational parameter for the media processing device for processing the media sheet to be processed; and,

feeding the media sheet to be processed to the media processing device; and

upon determining that the determined media class does not match the selected media class setting:

incrementing a mismatch count for the selected media class setting;

determining whether or not there have been more than a predetermined number of mismatches;

upon determining that the number of mismatches does not exceed the predetermined number of mismatches then repeating the actions of selecting based on the selected media class setting at least one operational parameter for the media processing device for processing the media sheet to be processed; and feeding the media sheet to be processed to the media processing device; and,

upon determining that the number of mismatches does exceed the predetermined number of mismatches:

using a mismatch look up table determine whether or not mismatch is acceptable;

upon determining that the mismatch is acceptable:

repeating the actions of selecting based on the selected media class setting at least one operational parameter for the media processing device for processing the media sheet to be processed and feeding the media sheet to be processed to the media processing device; and,

upon determining that the mismatch is not acceptable: selecting based on the determined media class, at least one operational parameter for the media processing device for processing the media sheet to be processed and feeding the media sheet to be processed to the media processing device.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and advantages of the disclosed embodiments, and the manner of attaining them, will become more apparent and will be better understood by reference to the following description of the disclosed embodiments in conjunction with the accompanying drawings.

FIG. **1** is a schematic illustration of an imaging system including an imaging device.

FIG. **2** is a schematic illustration of a system utilizing the presently disclosed Optical Translucence Sensor (OTS) assembly according to one example embodiment.

FIG. **3** is a schematic circuit for the OTS.

FIG. **4** illustrates a one piece example embodiment of an OTS assembly.

FIG. **5** illustrates the placement of the OTS assembly of FIG. **4** within one example embodiment of an imaging device.

FIG. **6** illustrates a two piece example embodiment of an OTS assembly.

FIG. **7** illustrates the placement of the OTS assembly of FIG. **6** within another example embodiment of an imaging device.

FIG. **8** illustrates a representative OTS output indicating interest zones and correlation to media leading edge positions P**1**-P**5** along the media path shown in FIG. **2**.

FIG. **9** is a table of the features or factors used by the media class determining equation set.

FIGS. **10**-**14** are tables of equation factors forming an example media class determining equation for light weight media, normal weight media, heavy weight media, cardstock media and transparency media, respectively.

FIG. **15** is a flow chart of one example embodiment of the present method for determining a media class in an imaging device.

FIGS. **16**-**17** are a flow chart of another example embodiment of the present method for determining a media class in an imaging device.

DETAILED DESCRIPTION

It is to be understood that the present disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following written description or illustrated in the drawings. The present disclosure is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. As used herein, the terms “having”, “containing”, “including”, “comprising”, and the like are open-ended terms that indicate the presence of stated elements or features, but do not preclude additional elements or features. The articles “a”, “an”, and “the” are intended to include the plural as well as the singular, unless the context clearly indicates otherwise. The use of “including,” “comprising,” or “having” and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof, as well as, additional items.

Terms such as “about” and the like that have a contextual meaning, are used to describe various characteristics of an object, and such terms have their ordinary and customary meaning to persons of ordinary skill in the pertinent art. Terms such as “about” and the like, in a first context mean “approximately” to an extent as understood by persons of ordinary skill in the pertinent art; and, in a second context, are used to describe various characteristics of an object, and in such second context mean “within a small percentage of” as understood by persons of ordinary skill in the pertinent art.

Unless limited otherwise, the terms "connected," "coupled," and "mounted," and variations thereof herein are used broadly and encompass direct and indirect connections, couplings, and mountings. In addition, the terms "connected" and "coupled" and variations thereof are not restricted to physical or mechanical connections or couplings. Spatially relative terms such as "top", "bottom", "front", "back", "rear", "side", "under", "below", "lower", "over", "upper", and the like, are used for ease of description to explain the positioning of one element relative to a second element. These terms are intended to encompass different orientations of the device in addition to different orientations than those depicted in the figures. Further, terms such as "first", "second", and the like, are also used to describe various elements, regions, sections, etc. and are also not intended to be limiting. Like terms refer to like elements throughout the description.

In addition, it should be understood that embodiments of the present disclosure include both hardware and electronic components or modules that, for purposes of discussion, may be illustrated and described as if the majority of the components were implemented solely in hardware. However, one of ordinary skill in the art, and based on a reading of this detailed description, would recognize that, in at least one embodiment, the electronic-based aspects of the invention may be implemented in software. As such, it should be noted that a plurality of hardware and software-based devices, as well as a plurality of different structural components may be utilized to implement the invention. Furthermore, and as described in subsequent paragraphs, the specific mechanical configurations illustrated in the drawings are intended to exemplify embodiments of the present disclosure and that other alternative mechanical configurations are possible.

It will be further understood that each block of the diagrams, and combinations of blocks in the diagrams, respectively, may be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer, processor, or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus may create means for implementing the functionality of each block or combinations of blocks in the diagrams discussed in detail in the descriptions below. These computer program instructions may also be stored in a non-transitory, tangible, computer readable storage medium that may direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer readable storage medium may produce an article of manufacture including an instruction means that implements the function specified in the block or blocks. Computer readable storage medium includes, for example, disks, CD-ROMS, flash ROMS, nonvolatile ROM and RAM. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions that execute on the computer or other programmable apparatus implement the functions specified in the block or blocks. The results of the computer program instructions may be displayed in a user interface or computer display of the computer or other programmable apparatus that implements the functions or the computer program instructions.

When applied to media, the term "output" as used herein encompasses media from any printing device such as color and black-and-white copiers, color and black-and-white printers, and multifunction devices that incorporate multiple functions such as scanning, copying, and printing capabilities in one device. Such printing devices may utilize ink jet, dot matrix, dye sublimation, laser, and any other suitable print formats. The term "button" as used herein means any component, whether a physical component or graphic user interface icon, that is engaged to initiate an action or event.

The term "image" as used herein encompasses any printed or electronic form of text, graphics, or a combination thereof. "Media" or "media sheet" refers to a material that receives a printed image or, with a document to be scanned, a material containing a printed image. The media is said to move along the media path and the media path extensions from an upstream location to a downstream location as it moves from the media trays to the output area of the imaging device. For a top feed option tray, the top of the option tray is downstream from the bottom of the option tray. Conversely, for a bottom feed option tray, the top of the option tray is upstream from the bottom of the option tray. As used herein, the leading edge of the media is that edge which first enters the media path and the trailing edge of the media is that edge that last enters the media path. Depending on the orientation of the media in a media tray, the leading/trailing edges may be the short edge of the media or the long edge of the media, in that most media is rectangular. As used herein, the term "media width" refers to the dimension of the media that is transverse to the direction of the media path. The term "media length" refers to the dimension of the media that is aligned to the direction of the media path. "Media process direction" describes the movement of media within the imaging system, and is generally means from an input toward an output of the imaging system **1**. Further, relative positional terms may be used herein. For example, "superior" means that an element is above another element. Conversely "inferior" means that an element is below or beneath another element

Media is conveyed using pairs of aligned rolls forming feed nips. The term "nip" is used in the conventional sense to refer to the opening formed between two rolls that are located at about the same point in the media path. The rolls forming the nip may be separated apart, be tangent to each other, or form an interference fit with one another. With this nip type, the axes of the rolls are parallel to one another and are typically, but do not have to be, transverse to the media path. For example, a deskewing nip may be at an acute angle to the media feed path. The term "separated nip" refers to a nip formed between two rolls that are located at different points along the media path and have no common point of tangency with the media path. Again, the axes of rotation of the rolls having a separated nip are parallel but are offset from one another along the media path. Nip gap refers to the space between two rolls. Nip gaps may be positive, where there is an opening between the two rolls, zero, where the two rolls are tangentially touching, or negative, where there is an interference fit between the two rolls.

As used herein, the term "communication link" is used to generally refer to a structure that facilitates electronic communication between multiple components. While several communication links are shown, it is understood that a single communication link may serve the same functions as the multiple communication links that are illustrated. Accordingly, a communication link may be a direct electrical wired connection, a direct wireless connection (e.g., infrared or r.f.), or a network connection (wired or wireless), such as for example, an Ethernet local area network (LAN) or a wireless networking standard, such as IEEE 802.11. Devices interconnected by a communication link may use a standard communication protocol, such as for example, universal serial bus (USB), Ethernet or IEEE 802.xx, or other communication protocols. The terms “input” and “output” when applied to a sensor, circuit or other electronic device means an electrical signal that is produced by or is acted upon by such sensor, circuit or electronic device. Such electrical signals may be analog or digital signals.

Referring now to the drawings and particularly to FIG. **1**, there is shown a diagrammatic depiction of an imaging system **1**. As shown, imaging system **1** may include an imaging device **2**, and an optional computer **50** attached to the imaging device **2**. Imaging system **1** may be, for example, a customer imaging system, or alternatively, a development tool used in imaging apparatus design. Imaging device **2** is shown as a multifunction machine that includes a controller **3**, a print engine **4**, a scanner system **6**, a user interface **7**, a finisher **8**, and/or one or more option assemblies **9**.

Controller **3** includes a processor unit **10** and associated memory **11**, and may be formed as one or more Application Specific Integrated Circuits (ASICs). Memory **11** may be any volatile or non-volatile memory or combination thereof such as, for example, random access memory (RAM), read only memory (ROM), flash memory and/or non-volatile RAM (NVRAM). Alternatively, memory **11** may be in the form of a separate electronic memory (e.g., RAM, ROM, and/or NVRAM), a hard drive, a CD or DVD drive, or any memory device convenient for use with controller **3**. One or more look-up tables **11-1** may be provided in memory **11**.

In FIG. **1**, controller **3** is illustrated as being communicatively coupled with computer **50** via communication link **41**, with user interface **7** via communication link **42**, and with scanner system **6** via communication link **43**. Controller **3** is illustrated as being communicatively coupled with print engine **4**, and finisher **8**, including stapler **12**, punch **13** and sensors **14**, **17**, via communication link **44**.

Computer **50** includes in its memory **51** a software program including program instructions that function as an imaging driver **52**, e.g., printer/scanner driver software, for imaging device **2**. Imaging driver **52** is in communication with controller **3** of imaging device **2** via communication link **41**. Imaging driver **52** facilitates communication between imaging device **2** and computer **50**. One aspect of imaging driver **52** may be, for example, to provide formatted print data to imaging device **2**, and more particularly to print engine **4**, to print an image. Another aspect of imaging driver **52** may be, for example, to facilitate collection of scanned data from scanner system **6**. In some circumstances, it may be desirable to operate imaging device **2** in a standalone mode. In the standalone mode, imaging device **2** is capable of functioning without computer **50**. Accordingly, all or a portion of imaging driver **52**, or a similar driver, may be located in controller **3** of imaging device **2** so as to accommodate printing and/or scanning functionality when operating in the standalone mode.

Print engine **4**, scanner system **6**, user interface **7** and finisher **8** may include firmware modules, generally designated **11-2**, maintained in memory **11** which may be performed by controller **3** or another processing element. Controller **3** may be, for example, a combined printer, scanner and finisher controller. Controller **3** serves to process print data and to operate print engine **4** and toner cartridge **91** during printing, as well as to operate scanner system **6** and process data obtained via scanner system **6** for printing or transfer to computer **50**. Controller **3** may provide to computer **50** and/or to user interface **7** status indications and messages regarding the media, including scanned media and media to be printed, imaging device **2** itself or any of its subsystems, consumables status, etc. Computer **50** may provide operating commands to imaging device **2**. Computer **50** may be located nearby imaging device **2** or be remotely connected to imaging device **2** via an internal or external computer network. Imaging device **2** may also be communicatively coupled to other imaging devices.

Scanner system **6** may employ scanning technology as is known in the art including for example, CCD scanners, optical reduction scanners or combinations of these and other scanner types. Scanner system **6** is illustrated as having an automatic document feeder (ADF) **60** having a media input tray **61** and a media output area **63**. Two scan bars **66** may be provided—one in ADF **60** and the other in the base **65**—to allow for scanning both surfaces of the media sheet as it is fed from input tray **61** along scan path SP to output area **63**. Imaging device **2** may also be configured to be a printer without scanning.

Finisher **8** may include a stapler **12**, a punch **13**, one or more media sensors **14**, various media reference and alignment surfaces and an output area **15** for holding finished media. Finisher **8** may also have a door **16** and a door open sensor **17**. Similar doors and sensors may also be provided on the housing of imaging device **2** and are not shown for purposes of clarity.

Print engine **4** is illustrated as including a laser scan unit (LSU) **90**, a toner cartridge **91**, an imaging unit **92**, and a fuser **93**, all mounted within imaging device **2**. Imaging unit **92** and toner cartridge **91** are supported in their operating positions so that toner cartridge **91** is operatively mated to imaging unit **92** while minimizing any unbalanced loading forces applied by the toner cartridge **91** on imaging unit **92**. Imaging unit **92** is removably mounted within imaging device **2** and includes a developer unit **94** that houses a toner sump and a toner delivery system. The toner delivery system includes a toner adder roll that provides toner from the toner sump to a developer roll. A doctor blade provides a metered uniform layer of toner on the surface of the developer roll. Imaging unit **92** also includes a cleaner unit **95** that houses a photoconductive drum and a waste toner removal system. An exit port on toner cartridge **91** communicates with an entrance port on developer unit **94** allowing toner to be periodically transferred from toner cartridge **91** to resupply the toner sump in developer unit **94**. Both imaging unit **92** and toner cartridge **91** may be replaceable items for imaging device **2**. Imaging unit **92** and toner cartridge **91** may each have a memory device **96** mounted thereon for providing component authentication and information such as type of unit, capacity, toner type, toner loading, pages printed, etc. Memory device **96** is illustrated as being in operative communication with controller **3** via communication link **44**. While print engine **4** is illustrated as being an electrophotographic printer, those skilled in the art will recognize that print engine **4** may be, for example, an ink jet printer and one or more ink cartridges or ink tanks or a thermal transfer printer; other printer mechanisms and associated image forming material.

The electrophotographic imaging process is well known in the art and, therefore, will be briefly described. During an imaging operation, laser scan unit **90** creates a latent image by discharging portions of the charged surface of photoconductive drum in cleaner unit **95**. Toner is transferred from the toner sump in developer unit **94** to the latent image on the photoconductive drum by the developer roll to create a toned image. The toned image is then transferred either directly to a media sheet received in imaging unit **92** from one of media input trays **21** or to an intermediate transfer member and then to a media sheet. Next, the toned image is fused to the media sheet in fuser **93** and sent to an output location **33**, finisher **8** or a duplexer **30**. One or more gates **34**, illustrated as being in operable communication with controller **3** via communication link **44**, are used to direct the media sheet to output location **33**, finisher **8** or duplexer **30**. Toner remnants are removed from the photoconductive drum by the waste toner removal system housed within cleaner unit **95**. As toner is depleted from developer unit **94**, toner is transferred from toner cartridge **91** into developer unit **94**. Controller **3** provides for the coordination of these activities including media movement occurring during the imaging process.

Controller **3** also communicates with a controller **18** in option assembly **9**, via communication link **44**, provided within each option assembly **9** that is provided in imaging device **2**. Controller **18** operates various motors housed within option assembly **9** that position media for feeding, feed media from media path branches PB into media path P or media path extensions PX as well as feed media along media path extensions PX. Controllers **3**, **18** control the feeding of media along media path P and control the travel of media along media path P and media path extensions PX.

Imaging device **2** and option assembly **9** each also include a media feed system **20** having a removable media input tray **21** for holding media M to be printed or scanned, a pick mechanism **22**, a drive mechanism **23** positioned adjacent removable media input trays **21**. Each media tray **21** also has a media dam assembly **24** and a feed roll assembly **25**. In imaging device **2**, pick mechanism **22** is mechanically coupled to drive mechanism **23** that is controlled by controller **3** via communication link **44**. In option assembly **9**, pick mechanism **22** is mechanically coupled to drive mechanism **23** that is controlled by controller **3** via controller **18** and communication link **44**. In both imaging device **2** and option assembly **9**, pick mechanisms **22** are illustrated in a position to drive a topmost media sheet from the media stack M into media dam **24** which directs the picked sheet into media path P or extension PX. Bottom feed media trays may also be used. As is known, media dam **24** may or may not contain one or more separator rolls and/or separator strips used to prevent shingled feeding of media from media stack M. Feed roll assemblies **25**, comprised of two opposed rolls—a driven roll under control of controllers **3** and/or **18** and an idler roll—feed media from an inferior unit to a superior unit via a slot provided therein.

In imaging device **2**, a media path P (shown in dashed line) is provided from removable media input tray **21** extending through print engine **4** to output area **33**, or when needed to finisher **8** or to duplexer **30**. Media path P may also have extensions PX and/or branches PB (shown in dotted line) from or to other removable media input trays as described herein such as that shown in option assembly **9**. Media path P may include a multipurpose input tray **22** provided on the housing of imaging device **2** or be incorporated into removable media tray **21** provided in imaging device **2** and a corresponding path branch PB that merges with the media path P within imaging device **2**. Along media path P and its extensions PX are provided media position sensors **80**-**83** which are used to detect the position of the media, usually the leading and trailing edges of the media, as it moves along the media path P or path extension PX. Media position sensor **80** is located adjacent to the point at which media is picked from each of the media trays **21** while media position sensors **81**, **82** are positioned further downstream from their respective media tray **21** along media path P or path extension PX. Media position sensor **81** also accommodates media fed along path branch PB from multipurpose media tray **26** and is illustrated at a position downstream of feed roll pair **100**. Media position sensor **82** is illustrated at a position on path extension PX downstream of media tray **21** in option assembly **9**. Additional media position sensors may be located throughout media path P and a duplex path **31**, when provided, and their positioning is a matter of design choice. Media position sensors **14**, and **80**-**82** may be an optical interrupter or a limit switch or other type of edge detector as is known to a person of skill in the art and detect the leading and trailing edges of each sheet of media as it travels along the media path P, path branch PB or path extension PX.

Media size sensors **83** are provided in image forming device **2** and each option assembly **9** to sense the size of media being feed from removable media input trays **21**. To determine media sizes such as Letter, A4, A6, Legal, etc., media size sensors **83** detect the location of adjustable trailing edge media supports and one or both adjustable media side edge media supports provided within removable media input trays **21** as is known in the art. Sensors **80**-**83** are shown in communication with controller **3** via communication link **45**.

Media feed roll pair **100** is driven by a drive mechanism **110**. Positioned downstream of media feed roll pair **100** and media sensor **80** is an optical translucence sensor (OTS) assembly **200**. Downstream of OTS assembly **200** are one or more media processing devices, such as scanner system **6**, stapler **12**, hole punch **13**, duplexer **30**, and fuser **93** and developer unit **94** of print engine **4**. Drive mechanism **110** and OTS assembly **200** are in communication with controller **3** via communication link **45**. OTS assembly **200** may also be located upstream of feed roll pair **100**. Also provided on communication link **45** are a temperature sensor **84**, a relative humidity sensor **85** and a process speed sensor **86**.

Referring to FIG. **2**, the structure and operation of OTS assembly **200** within imaging device **2** will be described. In FIG. **2**, a media feeding system MFS is shown feeding a media sheet M to OTS assembly **200**. Media feeding system MFS is illustrated as having a drive mechanism DM that is operatively coupled to a driven roll DR of feed roll pair FRP**1** formed by driven roll DR and idler roll IR forming feed nip N. Media feeding system MFS, including a feed roll pair FRP**1** having driven and idler rolls DR, IR, respectively, formed a feed nip N, is meant to be a representation of any of the various feed roll pairs available in imaging device **2** that are capable of feeding media sheet M along media path P. In one form, media feeding system MFS may be thought of as including feed roll pair **100** and drive mechanism **110** positioned along media path P upstream of the location of OTS assembly **200**.

OTS assembly **200** is illustrated at a position downstream of nip N. It should be noted that this described arrangement is for illustration only. OTS assembly **200** may be located at other positions along the media path P. OTS assembly **200** includes a light emitter **201**, such as LED **201**, and a photo-detector **202**, such as a photo-transistor, that are spaced apart from one another on opposite sides of the media path P and form a throat **203** through which media sheet M passes. A light beam **205** is shown being emitted by LED **201** and being received at photo-detector **202** at position P**2**. As illustrated, light beam **205** has not been attenuated by the presence of a media sheet M passing through throat **203** between LED **201** and photo-detector **202**. The leading edge LE of media sheet M is illustrated as being positioned slightly upstream of trigger device TD while its trailing edge TE is shown upstream of feed roll pair FRP**1**.

FIG. **3** illustrates a schematic diagram of the circuit for OTS assembly **200**. LED **201** is driven by a variable current source **210**. The output of current source **210** is controlled by a pulse width modulated signal **211** from controller **3** which in turn adjusts the intensity of light beam **205** of LED **201**. The output of photo-transistor **202** is fed into a signal conditioning circuit **214** and then into an analog to digital converter **216** whose output signal **218** is fed back to controller **3**. During calibration of OTS assembly **200** with no media present, the duty cycle of pulse width modulated signal **211** is adjusted to adjust the current flow through LED **201** so that the output of photo-transistor **202** is a predetermined value, for example, 2 volts. A calibration event may be used to initiate the calibration of OTS assembly **200**. Calibration events may be triggered or initiated by the passage of a predetermined amount of time, the processing of a predetermined number of media sheets, or prior to the passage of each media sheet M into OTS assembly **200**.

FIG. **4** illustrates one example form of OTS assembly **200**. A single piece u-shaped frame **220** houses LED **201** on one arm **221** with photo-transistor **202** being housed on the other arm **222**. Mounting tab **223** is illustrated as extending from arm **221**. An electrical connector **224** is provided outside of and adjacent to arm **222** of frame **220**. LED **201**, photo-transistor **202**, and connector **224** are mounted on a u-shaped circuit board **225** mounted in frame **220**. In FIG. **5**, frame **220** is shown mounted across media path P in an example imaging device **2** upstream of a feed roll pair FRP and downstream of a transfer point TP between a transfer roll **402** and an intermediate transfer belt assembly **400**. A toned image on intermediate transfer assembly **400** is transferred to a media sheet passing through transfer point TP prior to entering fuser **93**. Mounting tab **223** is secured by screw **226** inserted through hole **229** (see FIG. **4**) to a portion of a frame **2-1** in imaging device **2**. A snap-in peg **227** secures arm **222** to frame portion **2-1**. The depth of throat **203** allows LED **201** and photo-detector **202** to be positioned about 6 mm inboard of a side edge of a media sheet. The width of throat **203** in this example is about 20 mm. Media guides **230** are also shown.

FIG. **6** illustrates another example form of OTS assembly **200** as a two piece assembly. LED **201** is mounted on frame **240** while photo-transistor **202** is mounted on frame **241**. Connectors **242**, **243** are mounted on frames **240**, **241**, respectively, for LED **201** and photo-transistor **202**, respectively. In FIG. **7**, frames **240**, **241**, mounted by screws **246**, **247**, respectively to frame portion **2-1**, are positioned upstream of a feed roll pair FRP across the confluence **250** of two media paths P**1**, P**2** that combine to form media path P. Feed roll pair FRP feeds a media sheet into a bubble chamber **251** formed between media guides **261**, **262**. Feed roll pair FRP**3** feeds media along media path P**2** toward feed roll pair FRP while feed roll pair FRP**4** feeds media along media path P**1** toward feed roll pair FRP. Feed roll pair FRP**5** feeds media along media path extension PX from an option assembly **9**. Media path P**1** may be one from a media tray, such as media tray **21** in imaging device **2**, while media path P**2** may be a return media path from a duplexer or from a multi-purpose feed tray, such as feed tray **26**. The two-piece construction allows for an increased depth for throat **203** placing LED **201** and photo-detector **202** further inboard from a side edge of the media sheet, such as for example, about 37 mm inboard of a side edge of a media sheet. The width of throat **203** in this example is about 20 mm Media guides **260** are also shown positioned about media paths P, P**1** and P**2**.

Referring back to FIG. **2**, a trigger device TD is illustrated at a position upstream of OTS assembly **200** at point P**1**. Trigger device TD in one form may be media sensor **80** having an output signal that changes states when the leading edge LE and the trailing edge TE of media sheet M are detected. Trigger device TD may also be positioned upstream of feed roll pair FRP**1**. In another form, trigger device TD may be a signal sent from controller **3** to place OTS assembly **200** into a state, such as a ready state, from which an optical translucence measurement cycle on media sheet M would begin. Where trigger device TD is media sensor **80**, media sensor **80** is actuated by the leading edge LE of a media sheet M being feed by feed roll pair FRP. At position P**2**, an output signal of media sensor **80** changes state from a first state to a second state on detection of the leading edge LE. Conversely, when a trailing edge TE of media sheet M passes media sensor **80** that state of its output signal transitions from the second state to the first state. This transition may be used to signal controller **3** to stop use of OTS assembly **200**.

At position P**3** the leading edge LE of media sheet M has exited OTS assembly **200**. Downstream of OTS assembly **200**, at point P**4**, is shown a media processing device MPD having at its input a second feed roll pair FRP**2** positioned on media path P and which is used to guide media sheet M into the MPD. Use of feed roll pair FRP**2** is illustrative only as other means of directing media sheet M into the MPD may be used. A media processing device MPD is any device within imaging system **1** that manipulates or is affected by the media where the manipulation or effect may change because of the class of media that is at the media processing device. For example stapler **12** or hole punch **13** may require a greater drive force for heavier weight media class or fuser **93** may need to be decreased in temperature or increased in speed when processing lighter weight media class. Scanner system **6**, stapler **12**, hole punch **13**, duplexer **30**, fuser **93**, and developer unit **94** are shown as non-limiting examples as what is meant by the term media processing device. At point P**5**, the leading edge of media sheet M has exited the MPD.

Referring to FIG. **8**, an example output signal **218** of photo-detector **202** is shown. The Y-axis shows output voltage and the corresponding digital counts. The X-axis is time. At point P**1**, a trigger event has occurred and the trigger signal **280**, for example, the output signal of media sensor **80**, goes high. The output signal **218** reaches an initial maximum or initial peak value within interest zone Z**1**, and, at point P**2** on the media path P where the media sheet M initially enters OTS sensor assembly **200**. Between points P**2** and P**3**, output signal **218** settles back to a first steady state value. Subsequent to position P**4** within interest zone **3**, the output signal **218** begins to again increase in value until at interest zone **4** a new second steady state value is reached with the media at position P**5** on media path P. Thereafter, trigger signal **280** changes states and goes low. This may be due to the trailing edge of the media sheet M passing the trigger device TD or after the expiration of a predetermined time period. Thereafter, the output signal **218** goes low. The output signal **218** may be periodically sampled to collect the data in each interest zone. For example, output signal **218** may be sampled every 1-40 msec.

Media feeding system MFS and media processing device MPD are illustrated as being in operative communication with controller **3** via communication link CL**1**. LED **201** and trigger device TD are illustrated as being in operative communication with controller **3** via communication link CL**2**. The output signal of photo-detector **202** is in operative communication with controller **3** via communication link CL**3**. As shown the output signal of photo-detector **202** provides intrinsic media data IMD as detailed in FIG. **9** that forms an intrinsic variables data set. Extrinsic process data EPD collected from temperature, relative humidity, and process speed sensors **84-86** form an extrinsic variables data set including temperature EPD**1**, relative humidity EPD**2**, and process speed EPD**3**. EPD moisture content EPD**4** may be calculated from the measured temperature EPD**1** and relative humidity EPD**2**. Input source EPD**5** is provided via user interface **7** or by a default value set in firmware **11-2**. Similarly, a media type EPD**6** may be selected by a user via user interface **7** or from a default value stored in firmware. The intrinsic variables and extrinsic variables data sets are fed to signal conditioning circuits **220** and signal normalization circuits **230** to create a variables data set **240**. The media class determining equation set **320** in firmware **11-2** uses the variables data set to solve for a determined media class **321** from a predetermined media set containing a plurality of media classes. The determined media class **321** is then used to enter a look-up table to provide one or more operational parameters to be used by the media processing device MPD for the media sheet M that is to be processed.

Intrinsic variables are related to a characteristic of the media. These may include, but are not limited to, translucence, electrical impedance, reflectance, thermal capacitance, etc. Extrinsic variables include, but are not limited to, temperature, relative humidity, and/or the desired machine state, e.g., process speed. Table 1 provides example operational sensor sets that would meet several different levels of performance requirements. Optical transmission may also be referred to as optical transmission or translucence. Use of the image capture, for example, would provide some of the additional capabilities such as recognizing media having holes or preprinted portions. Optical sensors may be used to detect holes. Image capture may be done by use of charge coupled imaging device. Magnetic field may be detected by use of a Hall effect sensor. An RFID reader may be used to sense RFID tags.

TABLE 1

Intrinsic and Extrinsic Variables	
Variable Type	Measured or Calculated Variable
Intrinsic	Thermal Diffusivity
	Acoustic Transmission
	Microwave Transmission
	Heat Capacity
	Impedance Phase
	Impedance Magnitude
	Resistance
	Capacitance
	Contact resistance
	Dielectric constant
	Bending Stiffness
	Thickness
	Acoustic Absorption
	X-Ray
	Optical Transmission Mean
	Optical Transmission Deviation
	Optical Spectral Reflectance
	Optical Diffuse Reflectance
	Image Capture/Process
	Laser Profilometry

TABLE 1-continued

Intrinsic and Extrinsic Variables	
Variable Type	Measured or Calculated Variable
Extrinsic	Temperature
	Relative Humidity
	Media Size
	Transfer Current
	Transfer Voltage
	Fuser Temperature
	Media Feed Motor Current
	RFID
	Magnetic Field
	Media Holes
	MICR
	Preprinted Areas
	Media Color
	Multilayer Media

Media class determining equation set **320**, consisting of one equation for each class of media to be discerned is created using a classification system which is known in the art. An example classification system will be briefly described. The classification system creates the media class determining equation set that is found in firmware **11-2** incorporated into imaging device **2**. In a training or experimental environment, by the use of data sets of sampled inputs related to each of the media classes or types to be determined and extrinsic and intrinsic conditions that are the same as or comparable to those found in real world placements of imaging device **2**, the classification system is able to formulate the media class determining equation set **320**. Included in an example classification system is a training sensor set, a training media set comprised of a plurality of different media classes, a robot, a training imaging device substantially similar to imaging device **2**, and imaging device subsystems that are substantially similar to those found in imaging device **2**. A robot is simply a machine designed to perform a function of imaging device **2**. For example, the training system may use a fuser robot that performs fusing, a transfer station robot that performs toned image transfer to a media sheet, or a media feed robot that emulates feeding media sheets. The training sensor set is used to measure the same extrinsic and intrinsic variables data sets that will be used in imaging device **2** but related to the training imaging device, its subsystems, and robots that form training data sets for each media class. The training imaging device, robots, and subsystems are used in a laboratory or test enclosure so that environmental conditions could be controlled when making measurements as described herein.

The training sensor set, consisting of a predetermined collection of sensors, provides data measurement points to the classification system. As is known in the art, the types and number of sensors used will vary dependent upon the media classes or types included in training media set, the ambient conditions to be measured, the type of robots and training imaging device used, functional requirements, and customer requirements for imaging device **2**. The training sensor set is used in conjunction with the training media set, comprised of samples of M different media classes, and provides multiple data points for each variable in a predetermined set of intrinsic and extrinsic variables. Included in the predetermined set of variables that training sensor set measures are those relevant to each media class in the media set; ambient conditions, such as temperature and relative humidity where the training media set is located, and variables relevant to imaging device **2** such as electrical, thermal and mechanical properties measured using the robots or the training imaging device. An imaging device designer chooses variables that will provide a resolution sufficient to determine each media class M within the training media set. The list of variables set forth in FIG. **9** is one example variable data set. The chosen variables relevant to distinguishing the media classes in the training media set are empirically determined and verified. For imaging device **2**, the chosen variables to be measured are measured using subsystems equivalent to the subsystems found in imaging device **2**. These subsystems may be provided in the training imaging device or may be individually provided subsystems. It will be noted that each media class M in the media set is tested with each robot, the training imaging device, if present, or subsystems at several different ambient conditions and measurements are also taken at a plurality of locations within the borders of the media sheet. The use of robots and/or subsystems may obviate the need to use a training imaging device.

The training sensor set comprises extrinsic process sensors, and intrinsic media sensors that are the same as or equivalent to similar sensors that are present within imaging device **2**. When such extrinsic measurements are made, each media class in the training media set and each imaging device subsystem are measured at the desired extrinsic measurement points. For example, when temperature and relative humidity are being measured, each media class in the training media set and each imaging device subsystem are measured at several different temperature and humidity points, such as, for example, 22° C. at 50% relative humidity, 25.6° C. at 80% relative humidity, and 15° C. at 8% relative humidity. These temperature and humidity points are environments in which imaging device **2** may be placed.

The data for the variable data set having M media classes in the training media set is collected in a training data set for each media class M resulting in multiple training data sets. For data in the training data sets, the media class to which that data belongs is known. For example, should training media set have three media classes M**1**, M**2**, M**3**, three data sets would be collected. It will be appreciated that the number of data points within each data set will number in the thousands. In general, as the media classes M to be sensed in imaging device **2** increase in number, the number of variables N measured increases so that each media class M may be determined.

For the purposes of developing a media class determining equation that can successfully classify a media class given the different variable input magnitudes, the measured sensor values are normalized prior to training. This is done because units of Ohms have no physical comparison to units of optical transmission, degrees of temperature, or percent relative humidity, etc. The goal is to compare how the media is changing with respect to its physical properties and by normalizing the inputs to the same order of magnitude this can be more easily achieved. Before formulation of the media class determining equations, these input values are normalized such that the magnitudes of each of the inputs are roughly equivalent over the range expected by imaging device **2**, the media types expected to be used, expected environments of use, and one or more desired machine states, for example, 40 page per minute (ppm) process speed or 70 ppm process speed.

The M training data sets of N variables each are fed into a classifier training engine that produces a media class determining equation set containing M media class determining equations, where M is the number of media classes and N is the number of variables. It should be understood that the number of variables N does not have to equal the number of media classes M. The media type determining equation set will be replicated and installed into imaging device **2**. Classifier training engine uses a supervised machine learning algorithm to map inputs (sensed media variables or properties like bending stiffness, electrical impedance, acoustic transmittance, optical reflectance, etc.) to a given media class. In supervised learning, for a given input data set, the correct output is known. For data in the M training data sets, the media class to which that data belongs is known. With a classifier training engine, results are predicted in a discrete output and input variables are mapped to discrete classes—here discrete media classes. Once the media class determining equations are formed, these equations, when placed in imaging device **2**, take measured variable values from the sensor set provided in imaging device **2** as inputs and use them to determine the best class. The measured variable values are also termed instances. Classification into one of the several media classes may be done by multiclass classification or by combining multiple binary classifiers that deal with only two classes at a time. A classification scheme is advantageous since programs in many existing imaging device controllers are based upon a discrete categorization of media into type, weight, and roughness.

Classifier training engine may be one of well-known classification engines as known in the art that analyze data and recognize patterns for classification. These include a support vector engine, a neural network, a quadratic classifier, a Bayesian network, or a random forest classifier. Classifier training engine operates on the M training data sets to produce a multi-variable media class determining equation set. The media class determining equation set may be constructed in any of number of different ways. In one embodiment (created using regression techniques), it resembles a higher order multivariable polynomial. In another embodiment (created using neural networks), it resembles two theta matrices. The form of the media class determining equation will be determined by the type of classifier training engine used. Note that, once determined, the media classes determining equation set may be manipulated to take any convenient mathematical form.

For imaging device **2** shown in FIG. **2**, FIGS. **10**-**14** set out the polynomial factors for the equations for classifying five media classes—light weight media, normal weight media, heavy weight media, card stock, and transparencies, respectively. In each equation, K represents a constant or offset. For example, the Equation 1 below shows the start of the media class determining equation for light weight media shown in FIG. **10**:

$$-0.31350669x1+2.50705501x2-1.27206377x3-0.42903456x4+1.51272236x5-090759126x6-0.49354008x7-0.39329021x8+0.40040825x9-046230815x10-0.87184194x11-0.73143359x12+2.26173243x13+4.7013063x14-0.2638741x15-0.24376869x16-0.02620652x17+1.477559967x18-0.70134319x19-1.21459248x20-0.47459542x21\ldots+K \qquad \text{Equation 1}$$

where the variables x1-x21 and the constant K are defined in the table shown in FIG. **10**

The remaining cross terms for Equation 1 are found in FIG. **10**. Similar equations for the other media classes may be constructed in a similar manner using the values found in FIGS. **11**-**14**.

As used herein the term "light weight media" means media having a weight of 60-75 g/m^2; the term "normal weight media" means media having a weight of 75-90 g/m^2; the term "heavy weight media" means media having a weight of 90-120 g/m^2; the term "card stock" means media having a weight of 120-199 g/m^2.

A single media class determining equation is produced for each media class in the training media set so that there is a plurality of equations in the media class determining equation set **40** corresponding to the plurality of media classes in the media set to be used with imaging device **2**. As is known in the art, the media class determining equations may be represented in any convenient mathematical manner that closely approximates the solution, for example, a Taylor polynomial. In one form, the classifier training engine produces a function having higher order polynomial equations that comprise the media class determining equation set **320** that is used in imaging device **2**. Variable measurement values taken by the sensor set in imaging device **2** are then inputted to the function (i.e., the M media class determining equations) to determine the classes of media sensed.

Referring now to FIG. **15**, a block diagram of a method M**1** of using the aforementioned OTS assembly **200** for determining a media class on a media sheet moveable along a media path P in imaging device **2** is illustrated. Process M**1** starts at block B**10** and proceeds to block B**15** where the media class determining equation set and predefined interest zones, such as interest zones Z**1**-Z**4**, are stored in the memory **11** of imaging device **2**. Continuing to block B**20**, the output signal of OTS assembly **200** is calibrated as previously described. At block B**25**, the collection and/or calculation of extrinsic process variables data occurs, such as measuring the temperature, relative humidity, process speed, media source, etc. At block B**30**, a media sheet to be processed is fed through OTS sensor assembly **200** and at block B**35**, collection and/or calculation of intrinsic media variables data occurs, such as by periodically sampling the output signal of OTS assembly **200** as the predefined interest zones Z**1**-Z**4** while the media sheet to be processed passes through OTS sensor assembly **200**. The intrinsic media variables are, for example, those listed in FIG. **9**. Making dynamic measurements while the media sheet to be processed is moving allows for understanding the interaction of the media sheet to be processed with the media path and allows for determining the uniformity of the media sheet to be processed by tracking the min, max, and range variables listed in FIG. **9**. At block B**40**, calculation of variables values using the collected intrinsic media variables data and extrinsic process variables data occurs to create respective intrinsic and extrinsic variables data sets. At block B**45**, the intrinsic and extrinsic variables data sets are normalized. At block B**50**, the media determining equation set is solved for a determined media class using the normalized intrinsic and extrinsic variables data sets.

At block B**55**, an operating parameter for a media process device MPD is selected using the determined media class and, at block B**60**, the media sheet is fed to the MPD for processing. At block B**65**, method M**1** ends. The selected operating parameter of imaging device **2** to be adjusted may be one of: a process speed within the print engine **4**, a duplex control scheme, a fuser temperature, a transfer voltage, an output location and a finishing process such as stapling or hole punching. The top speeds of a print engine are designed to support common media weights such as twenty pound media. For thicker/heavier media, the controller **3** would slow the media speed to ensure that the media can be picked, fed and fused. A slower media speed increases the residence time in the fuser **93** providing a higher amount of energy needed to fuse toner to the heavier weight media classes. Fusing temperature is dependent on media thickness. The heavier the media, the more energy is needed to ensure proper fusing of toner to it. If the imaging device **2** cannot maintain a fusing temperature due to the available line voltage, controller **3** may increase fuser temperature and/or reduce media speed to ensure proper fusing as media weight increases. The transfer voltage refers to the voltage needed to transfer the toned image onto the media sheet. For a media class of a heavier weight, a higher transfer voltage may be needed. For a given media class, the controller **3** can either increase or decrease the transfer voltage and/or increase or decrease process speed to ensure proper toner transfer to the media sheets in that media class. The duplex control scheme may be selected based on media class where the controller **3** may elect not to send a sheet of a heavier weight media class through a duplex path because turn radii in the duplex path may not be optimized for the heavier media class. Media class may also determine the choice of output location and/or finishing options that would be available in that heavier media may not be able to be sent to a given output location due to small radius turns in the media path or that the number of sheets of heavier media classes may need to be limited as compared to the number of sheet of lighter weight media classes when undergoing stapling and hole punching. When finishing lighter weight media classes, stapling force and/or hole punch force may need to be decreased.

FIGS. **16-17** present another example method M**2** for determining a media class for a media sheet using the OTS assembly **200** and then processing the media sheet in a media processing device of the imaging device **2**. Process M**2** starts at block B**100** and proceeds to block B**105** where the media class determining equation set, predefined variables data set, such as those listed in FIG. **9**, and predefined interest zones, such as interest zones Z**1**-Z**4**, and a lookup table of operating parameters are stored in the memory **11** of imaging device **2**. Continuing to block B**110**, a determination is made whether or not an OTS assembly calibration event has occurred. When it is determined that a calibration event, such as a power on reset, or the passage of a predetermined time period or number of media sheets, etc., has occurred, at block B**115**, the OTS assembly **200** output signal is calibrated as previously described. Thereafter method M**2** proceeds to block B**120**. When it is determined that a calibration event has not occurred, method M**2** proceeds to block B**120**. At block B**120**, the extrinsic process variables data are collected. At block B**125**, a trigger event is detected, and, at block B**130**, a media sheet to be processed is fed through the OTS assembly **200**. At block B**135**, the output signal of the OTS assembly **200** is monitored. At block B**140**, a determination is made whether or not the OTS assembly **200** output signal is greater than a predetermined threshold. When it is determined that the output signal of the OTS assembly is not greater than a threshold value, method M**2** loops back to block B**140**. When it is determined that the output signal of OTS assembly **200** is greater than the threshold, then at block B**145**, the OTS assembly **200** output signal is periodically sampled at the predefined interest zones and the intrinsic media variables data is collected and/or calculated. It will be recognized that this looping may be limited in number or in time as is known in the art.

At block B**150**, calculation of values for a variables data set (VDS) using the intrinsic media variables data and the extrinsic process variables data is performed. Thereafter, at block B**155**, the VDS is normalized. At block B**160**, the media determining equation set is solved for a determined media class using the normalized VDS. At block B**165**, a determination is made whether or not the determined media class matches a media class setting. The media class setting may be a user entered setting or a default setting of imaging device **2**. When it is determined that the determined media class matches the MPD media class setting, method M**2** proceeds to block B**170** where an operating parameter for the media process device MPD is selected using the MPD media class setting, and, at block B**175**, the media sheet is fed to the MPD for processing. At block B**180**, method M**2** ends.

When it is determined that the determined media class does not match the MPD media class setting, method M**2** proceeds to block B**185** where a mismatch count is incremented. At block B**190**, a determination is made whether or not there have been more than a predetermined number of mismatches. When it is determined that there has not been more than a predetermined number of mismatches, method M**2** returns to block B**170** where an operating parameter for the media process device MPD is selected using the media class setting. When it is determined that there has been more than a predetermined number of mismatches, method M**2** proceeds to block B**195** to go to a mismatch lookup table. Thereafter, at block B**200**, a determination is made whether or not the mismatch is acceptable. An acceptable mismatch may occur when the media class setting and the determined media class are similar. For example, a mismatch between a determined media class of normal weight and a media class setting of heavy weight media may be acceptable whereas a mismatch between a determined media class of normal weight media and a media class setting of a transparency would not. The list of acceptable and unacceptable mismatches is a matter of design choice. When it is determined that the mismatch is acceptable, method M**2** returns to block B**170** where an operating parameter for the media process device MPD is selected using the media class setting. When it is determined that the mismatch is unacceptable, method M**2** proceeds to block B**205** where an operating parameter for the MPD is selected using the determined media class. Thereafter, method M**2** returns to block B**175** for the processing of the media sheet.

The foregoing description of embodiments has been presented for purposes of illustration. It is not intended to be exhaustive or to limit the present disclosure to the precise steps or their illustrated order and/or forms disclosed. Obviously many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be defined by the claims appended hereto.

What is claimed is:

1. In an imaging device using a media set having a predetermined number of media classes, the imaging device including a media processing device, a plurality of media input sources, a media feeding system in communication with the media processing device and the plurality of media input sources, an optical translucence sensor (OTS) mounted on a media path between the plurality of media input sources and the media processing device, the imaging device operable at a plurality of media process rates, the media feeding system feeding a media sheet to the media processing device for processing thereat, the OTS having an output signal representative of the translucence of the media sheet, a method of determining a media class from media set for a media sheet to be processed by the media processing device in the imaging device, the method comprising:

storing in memory of the imaging device media class determining equation set incorporating a predetermined plurality of media class determining equations using a predetermined set of variables wherein each media class determining equation corresponds to one media class of the media set;

at a controller in the imaging device:

determining a selected media source from the plurality of media sources;

determining a process rate from the plurality of process rates;

forming an extrinsic variables data set including the selected media source and the determined process rate;

providing an indication that the media sheet to be processed is in position to enter the OTS;

passing the media sheet to be processed through the OTS;

measuring the output signal of the OTS at a plurality of predefined interest zones during the passage therethrough of the media sheet to be processed;

forming an intrinsic variables data set from the measurements of output signal of the OTS;

normalizing the intrinsic variables data set and the extrinsic variables data set;

solving the media class determining equation set using the normalized intrinsic and extrinsic variables data sets to determine for the media sheet to be processed a media class from the media set; and,

selecting, based upon the determined media class, at least one operational parameter for the media processing device for processing the media sheet.

2. The method of claim **1** wherein the media set includes light weight media, normal weight media, heavy weight media, cardstock, and transparencies.

3. The method of claim **1** wherein the plurality interest zones include a first interest zone where the media sheet to be processed initially enters the OTS and the output signal of the OTS reaches an initial peak value, a second interest zone subsequent to the first interest zone where the output signal of OTS settles to a first steady state value, a third interest zone where the output signal of the OTS begins to increase in value from the first steady state value, and a fourth interest zone where the output signal of the OTS reaches a second steady state value.

4. The method of claim **3** wherein the measurements of the output signal of the OTS in the first interest zone includes an initial maximum value, in the second interest zone includes a first mean value, a first minimum value, a first early maximum value, and a first range value, in the third interest zone includes a second mean value, a second minimum value, a second maximum value and a second range value, and, in the fourth interest zone includes a third mean value, a third minimum value, a third maximum value and a third range value, and a first delta between the first mean and the initial maximum values, a second delta between the first mean and the second mean values, a third delta between the first mean and third mean values, and a fourth delta between the second mean and third mean values.

5. The method of claim **1** wherein, prior to passing the media sheet to be processed through the OTS, performing a calibration of the OTS sensor wherein, with no media sheet present therein, the output signal of the OTS is set to a predetermined value by adjusting an input current to the OTS.

6. The method of claim **1** wherein the at least one operating parameter is selected from a group of operating parameters consisting of: a media speed within the print engine, a duplex control scheme, a fuser temperature, a transfer voltage, an output location, and a finishing process.

7. In an imaging device using a media set having a predetermined number of media classes, the imaging device including a media processing device, a plurality of media input sources, a media feeding system in communication with the media processing device and the plurality of media input sources, an optical translucence sensor (OTS) mounted on a media path between the plurality of media input sources and the media processing device, a temperature sensor, and a relative humidity sensor, the imaging device operable at a plurality of predetermined media process rates, the media feeding system feeding a media sheet to the media processing device for processing thereat, the OTS having an output signal, a method of determining a media class from media set for a media sheet to be processed by the processing device in the imaging device, the method comprising:

storing in memory of the imaging device a media class determining equation set incorporating a predetermined plurality of media class determining equations using a predetermined set of variables wherein each equation corresponds to one media class of the media set;

measuring the temperature and relative humidity;

calculating a moisture content value using the measured temperature and relative humidity values;

determining a selected media source from the plurality of media sources;

determining a process rate from the plurality of process rates;

forming an extrinsic variables data set including the selected media source, the determined process rate, the calculated moisture content, the measured temperature, and the measured relative humidity;

passing the media sheet to be processed by the media processing device through the OTS

measuring the output signal of the OTS at a plurality of predefined interest zones during the passage therethrough of the media sheet to be processed;

forming an intrinsic variables data set from the measurements of output signal of the OTS;

normalizing the intrinsic variables and the extrinsic variables data sets;

solving the media class determining equation set using the normalized intrinsic variables and extrinsic variables data sets to determine for the media sheet to be processed a media class from the media set; and,

selecting, using a look up table and based upon the determined media class, at least one operational parameter for the media processing device for processing the media sheet.

8. The method of claim 7 wherein the media set includes light weight media, normal weight media, heavy weight media, cardstock, and transparencies.

9. The method of claim 8 wherein, prior to passing the media sheet to be processed through the OTS, performing a calibration of the OTS sensor wherein with no media sheet present therein, the output signal of the OTS is set to a predetermined value by adjusting an input current to the OTS.

10. The method of claim 8 wherein the at least one operating parameter is selected from a group of operating parameters consisting of: a media speed within the print engine, a duplex control scheme, a fuser temperature, a transfer voltage, an output location, and a finishing process.

11. The method of claim 7 wherein the plurality interest zones include a first interest zone where the media sheet to be processed initially enters the OTS and the output signal of the OTS reaches a peak value, a second interest zone subsequent to the first interest zone where the output signal of OTS settles to a first steady state value, a third interest zone where the output signal of the OTS begins to increase in value from the first steady state value, and a fourth interest zone where the output signal of the OTS reaches a second steady state value.

12. The method of claim 11 wherein the measurements of the output signal of the OTS in the first interest zone includes an initial maximum value, in the second interest zone includes a first mean value, a first minimum value, a first early maximum value, and a first range value, in the third interest zone includes a second mean value, a second minimum value, a second maximum value and a second range value, and, in the fourth interest zone includes a third mean value, a third minimum value, a third maximum value and a third range value, and a first delta between the first mean and the initial maximum values, a second delta between the first mean and the second mean values, a third delta between the first mean and third mean values, and a fourth delta between the second mean and third mean values.

13. In an imaging device using a media set having a predetermined number of media classes, the imaging device including a media processing device, a plurality of media input sources, a media feeding system in communication with the media processing device and the plurality of media input sources, an optical translucence sensor (OTS) mounted on a media path between the plurality of media input sources and the media processing device, a temperature sensor, and a relative humidity sensor, the imaging device operable at a plurality of media process rates, the media feeding system feeding a media sheet to the media processing device for processing thereat, the OTS having an output signal, a method of determining a media class from media set for the media sheet to be processed by the media processing device, the method comprising:

storing in memory of the imaging device a media class determining equation set incorporating a predetermined plurality of media class determining equations using a predetermined set of variables wherein each equation corresponds to one media class of the media set;

measuring the temperature and relative humidity;

calculating a moisture content value using the measured temperature and relative humidity values;

determining a selected media source from the plurality of media sources;

determining a process rate from the plurality of process rates;

forming an extrinsic variables data including the selected media source, the determined process rate, the calculated moisture content, the measured temperature, and the measured relative humidity;

determining whether or not an OTS calibration event has occurred;

upon determining that an OTS calibration event has occurred performing a calibration of the OTS wherein, with no media sheet to be processed present therein, the output signal of the OTS is set to a predetermined value by adjusting an input current to the OTS;

feeding the media sheet to be processed into a nip formed between a pair of feed rolls positioned along the media path prior to the OTS;

on the occurrence of a trigger event, feeding the media sheet to be processed through the OTS;

determining whether or not the OTS output signal is greater than a predetermined threshold value

upon determining that the OTS output signal is not above the predetermined threshold value then repeating the action of determining whether or not the OTS output signal value is greater than the predetermined threshold value;

upon determining that the OTS output signal is above the predetermined threshold value periodically measuring the OTS output signal value at a plurality of predefined interest zones as the media sheet to be processed is feed from the nip through the OTS forming an intrinsic variables data;

forming a variables data set from the extrinsic process variables data and the intrinsic media variables data;

normalizing the variables data set;

solving the media class determining equation set using the normalized variables data set to determine for the media sheet to be processed a media class from the media set;

determining whether or not the determined media class matches a selected media class setting for the media processing device;

upon determining that the determined media class matches the selected media class setting:

selecting, based upon the selected media class setting, at least one operational parameter for the media processing device for processing the media sheet to be processed; and,

feeding the media sheet to be processed to the media processing device;

and,

upon determining that the determined media class does not match the selected media class setting:

incrementing a mismatch count for the selected media class setting;

determining whether or not there have been more than a predetermined number of mismatches;

upon determining that the number of mismatches does not exceed the predetermined number of mismatches then repeating the actions of selecting based on the selected media class setting at least one operational parameter for the media processing device for processing the media sheet to be processed; and feeding the media sheet to be processed to the media processing device;

and,

upon determining that the number of mismatches does exceed the predetermined number of mismatches:

using a mismatch look up table to determine whether or not mismatch is acceptable;

upon determining that the mismatch is acceptable:

repeating the actions of selecting based on the selected media class setting at least one operational parameter for the media processing device for processing the media sheet to be processed and feeding the media sheet to be processed to the media processing device;

and,

upon determining that the mismatch is not acceptable:

selecting based on the determined media class, at least one operational parameter for the media processing device for processing the media sheet to be processed and feeding the media sheet to be processed to the media processing device.

14. The method of claim **13** wherein the media set includes light weight media, normal weight media, heavy weight media, cardstock, and transparencies.

15. The method of claim **13** wherein the plurality interest zones include a first interest zone where the media sheet to be processed initially enters the OTS and the output signal of the OTS reaches a peak value, a second interest zone subsequent to the first interest zone where the output signal of OTS settles to a first steady state value, a third interest zone where the output signal of the OTS begins to increase in value from the first steady state value, and a fourth interest zone where the output signal of the OTS reaches a second steady state value.

16. The method of claim **15** wherein the measurements of the output signal of the OTS in the first interest zone includes an initial maximum value, in the second interest zone includes a first mean value, a first minimum value, a first early maximum value, and a first range value, in the third interest zone includes a second mean value, a second minimum value, a second maximum value and a second range value, and, in the fourth interest zone includes a third mean value, a third minimum value, a third maximum value and a third range value, and a first delta between the first mean and the initial maximum values, a second delta between the first mean and the second mean values, a third delta between the first mean and third mean values, and a fourth delta between the second mean and third mean values.

17. The method of claim **13** wherein the at least one operating parameter is selected from a group of operating parameters consisting of: a media speed within the print engine, a duplex control scheme, a fuser temperature, a transfer voltage, an output location, and a finishing process.

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